

PATIENT MONITOR PM 8500

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MANUAL BOOK



Elitech[®]
TECHNOVISION

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Chapter 1 Safety

1.1 Safety Information



WARNING

- Indicates a potential hazard or unsafe practice that, if not avoided, could result in death or serious injury.

CAUTION

- Indicates a potential hazard or unsafe practice that, if not avoided, could result in minor personal injury or product/property damage.

NOTE

- Provides application tips other useful information to ensure that you get the most from your product.

1.1.1 Safety Information



WARNING

- Before using the device, the equipment, patient cable and electrodes etc. should be checked. Replacement should be taken if there is any evident defect or signs of aging which may impair the safety or performance to make sure it work properly and safely
- The monitor is intended for clinical monitoring application with operation only granted to appropriate medical staff
- The monitor can be used on only one patient at a time
- Do not use the equipment in oxygen-enriched atmosphere where concentrations of flammable anesthetics or other materials may occur to prevent fire and explosion.
- There could be hazard of electrical shock by opening the monitor casing. All servicing and future upgrading to this equipment must be carried out by personnel trained and authorized by our company.
- To prevent delayed treatment, sufficient alarm setup should be done according to individual patient situation and make sure that alarm sound can be activated when alarm occurs.
- Do not touch the patient, table, or the device during defibrillation.
- The monitor cannot be applied directly to the human heart. If simultaneously used with cardiac defibrillator or other electrical equipment, silver-silver chloride chest electrode and ECG lead cables with anti defibrillation function should be selected. If the defibrillation time is

more than 5s, disposable chest electrode shoul be used to avoid the metal electrode burning the patient's skin. It is better not to use it with other electrical equipment at the same time. If must, professional and technical personnel must be present for guidance, and the selected accessories should be the accessories designated by our company.

- When used with Electra-surgery equipment, the operator (doctor or nurse) must give top priority to the patient safety.
- The equipment interconnected with the monitor shall form an equipotential system (effective connection of protective earthing).
- If the protective earthing system is unstable or the integrity of arranging cables is in doubt, the monitor should apply internal power supply.
- This device can only be connected to a power socket with protective earthing. If the power socket is not grounded, do not use the socket and the monitor should be power supplied by rechargeable batteries. Do not connect the three-wire cable to a second-wire plug.
- The information of physiological waveform, physiological parameters and alarm, etc., shown on the monitor is for medical reference only, it cannot be regarded as the basis for clinical treatment directly.
- The alarm volume and alarm limit should be set according to the actual condition of patients. The operator can not only rely on the sound alarm system to monitor the patient. If the alarm sound is adjusted to a lower volume, the patient may be in danger. The operator should pay close attention to the actual clinical condition of patients.
- Be careful to place the power cord and various cables of accessories to avoid the patient being wound or suffocated, or the cable entangled together, or subject to electrical interference.
- The disposal of scrap device, its accessories and packaging should follow the local laws and regulations, to avoid polluting to the local environment. And the packaging materials must be placed in the region where the children are out of reaching.
- For patients with pacemakers! The heart rate meter may count pacemaker pulses in the event of cardiac arrest or arrhythmia. Don't rely solely on the heart rate meter for alarm. Patients with pacemakers should be monitored closely. Refer to this manual for the ability of the equipment to inhibit pacing pulses.
- The monitor is suitable for the use of Electra-surgery equipment, but when used with Electra-surgery equipment, the operator (doctor or nurse) must give top priority to the patient safety.
- The device does not protect against patient burning, and special care must be taken when using high-frequency surgical equipment. Many parts of the human/machine circuit (e.g. patients, connectors, electrodes and sensors) are conductive. When connected to the insulated patient input port of the device, it is important to ensure that these conductive parts do not come into contact with other grounded conductive parts. These contacts will result in the connection of the patient insulation system, thus

invalidating the protection provided by the input. In particular, the neutral electrode must not be in contact with the ground.

- Please do not remove the battery when monitoring.

1.1.2 CAUTION

CAUTION

- To ensure patients' safety, please use the accessories specified in this manual.
- The monitor's service life is 10 years. At the end of its service life, the product described in this manual, as well as its accessories, must be disposed in compliance with related local regulations or hospital regulations.
- Electromagnetic fields can affect the performance of the monitor, so other equipment used near the monitor must meet the appropriate EMC requirements. Mobile phones, X-rays, or MRI devices are possible sources of interference because they could emit high-intensity electromagnetic radiation.
- Before turning on the power to the equipment, make sure that the supply voltage and frequency match the device's label or the requirements specified in this manual.
- Please install or carry the equipment properly to prevent the device from falling, collision, strong vibration or other mechanical force damage.
- The monitor must be dried immediately after being exposed to rain.
- Please don't mix of different types and brands of electrode. Mixing of electrodes may result in larger baseline drift or longer baseline recovery time after defibrillation.

1.1.3 NOTE

NOTE

- Install the equipment in a location that is easy to observe, operate and maintain.
- Keep the manual near the device for convenient and timely accessed when needed.
- The software is developed in accordance with IEC62304. The possibility of risks caused by program error has been minimized.
- The user manual contains descriptions concerning all configurations, so the product you purchased may not have some configuration or functions.

1.2 Symbols

Your device may not contain all the following symbols.

	General Warning Sign		Attention! Please read the accompanying file (the user manual)
	Battery		ON/OFF
	Polarity of d.c. power connector		Alternating current (AC)
	Gas Outlet		Gas inlet
	USB Port		Network Port
	Equipotential		Service life
	Serial number		Batch Code
	Date of manufacturer		Manufacturer
	Part Number		Latex free
	Waste disposal mark, this symbol indicates that the waste of electrical and electronic equipment cannot be disposed as an unclassified municipal waste and must be recovered separately.		

	This symbol indicates that the applied part belongs to type BF, also the unit contains type F isolated (floating) applied part, and it has defibrillation proof function, but does not include direct cardiac application
	This symbol indicates that the applied part belongs to type CF. also the unit contains type F isolated (floating) applied part, and it has defibrillation proof function, including direct cardiac application.

Chapter 2 General

2.1 Introduction

2.1.1 Product Introduction

The patient monitor is suitable for clinical monitoring of adults, pediatrics and neonates. The Patient Monitor is to be used in healthcare facilities. It cannot be used for out-of-hospital transport. The patient monitor is applicable for monitoring physiological parameters such as ECG (including ST segment measurement and arrhythmia analysis), respiration (RESP), body temperature (TEMP), saturation of pulse oxygen (SpO_2), pulse rate (PR), noninvasive blood pressure (NIBP), invasive blood pressure (IBP) and carbon dioxide (CO_2). The monitoring information could be displayed, reviewed, stored and printed.



WARNING

- The monitor should be used by a qualified clinician or under the guidance of a professional clinician. Personnel who uses this monitor should be adequately trained. The personnel without authorized or who are not trained, shall not carry out any operation.

2.1.2 Contraindications

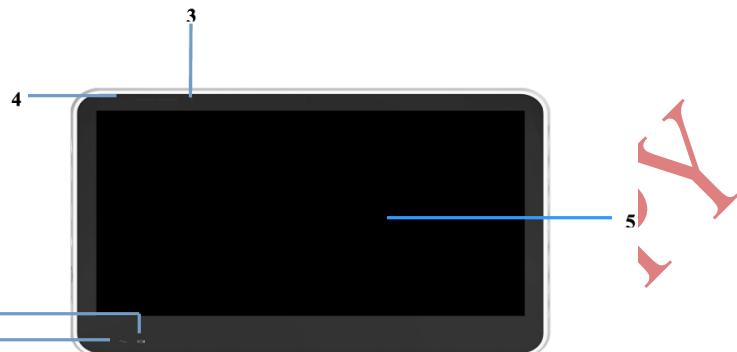
The NIBP measurement cannot be performed on patients with sickle-cell disease.

2.1.3 Product Composition

The monitor is composed of main unit, battery, display screen and corresponding accessories.

2.2 Main Unit

2.2.1 Front View



1. Battery Status indicator

- ◆ On : It always displays orange in charging state and green after fully charged.
 - ◆ Off : battery failure, or not connecting to AC power supply when the monitor in turning off state
 - ◆ Flicking: Battery is being used to power the monitor.
- #### 2. Power indicator
- ◆ On: The monitor is connected to power supply.
 - ◆ Off: The monitor is disconnected from power supply.

CAUTION

Although not recommended, you can press and hold the power on/off switch for 10 seconds to forcibly shut down the monitor when it could not be shut down normally or under some special situations. This may cause loss of data of the patient monitor.

3. Ambient light sensing lamp

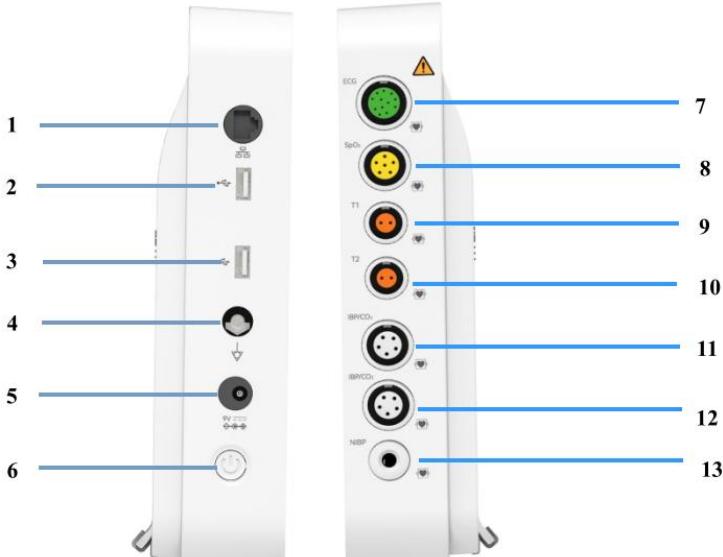
When the screen brightness is set to automatic adjustment, the system can automatically adjust the screen brightness according to the intensity of ambient light.

4. Alarm indicator

- Indicates the level of technical alarm and physiological alarm in different colors and flicking frequency:
 - ◆ High level physiological alarm: Red, fast flicking frequency.
 - ◆ Secondary physiological alarm: Yellow, slow flicking frequency.

- ◆ Low level physiological alarm: Yellow, normally on without flicking.
 - Technical alarm indicator
 - ◆ High level technical alarm: Red, fast flicking frequency.
 - ◆ Secondary technical alarm: Yellow, slow flicking frequency.
 - ◆ Low level technical alarm: Yellow, normally on without flicking.
5. Display screen

2.2.2 Side View



- CON**
1. Network Interface
Standard RJ 45 interface, connecting with the central monitoring system of our company by network cable.
 2. USB Interface
Connecting the USB device.
 3. USB Interface
Connecting the USB device.
 4. Equipotential grounding terminal
When the monitor is used together with other equipment, use a cable to connect other equipment to the equipotential terminal of the

monitor, so that it eliminates the ground potential difference between the different equipment to ensure safety.

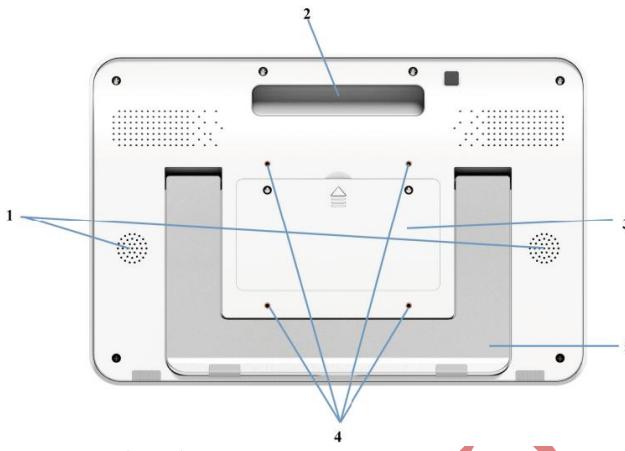


WARNING

The room protective grounding system is realized by power plugs grounding, it already includes the primary protection of the device. For internal examination of the heart or brain, the portable monitoring system must be individually connected to the equipotential grounding system. One end of the equipotential grounding wire (potential equalization wire) is connected to the equipotential grounding terminal on the rear panel of the device and the other end is connected to a connector of the equipotential system. If the protective grounding system is damaged, the equipotential grounding system undertakes the safety function of protecting the grounding wire. The examination of the heart (or brain) should only be carried out in a medical room with a protective grounding system. Before each use, check whether the device is in good working condition. The cable connecting the patient and the device must be free from electrolyte contamination.

5. Power socket
To connect with external power supply.
6. Power Button
ON: press it to turn on the device
OFF: under turning on state, press and hold the button for 3 seconds to turn it off.
7. Socket for ECG cable
8. Socket for SpO₂ sensor
9. Socket for channel 1 TEMP probe
10. Socket for channel 2 TEMP probe
11. Socket for IBP/CO₂ module
12. Socket for IBP/CO₂ module
13. Socket for NIBP cuff

2.2.3 Rear View



1. Loudspeaker
2. Handle
3. Battery Cover
4. Bracket fixing hole
5. Device stand

2.3 On Screen Display

This monitor adopts high resolution color TFT LCD screen, which can clearly display all physiological parameters and waveforms of patients. The following picture shows a standard interface in normal monitoring state.



1. Patient information area

It displays the department, bed number, age, patient name or patient type.

The appearance of  means that there is no admitted patient or the patient information is not complete.

In the case that there are no admitted patients, when select this area, the menu of [**Patient Management**] can be opened. In the case that there are admitted patients, when select this area, the menu of [**Patient Information**] can be opened.

2. Prompt message area

It displays the system prompt messages, and cycle displays for multiple pieces of messages.

3. Technical alarm area

It displays technical alarms and prompt messages, and cycle displays for multiple pieces of messages. When select this area, the menu of [**Technical Alarm**] can be opened.

4. Configure and deploy the display area

It displays current configuration and deployment.

5. Physiological alarm area

It displays physiological alarm messages, and cycle displays for multiple pieces of messages. When select this area, the menu of [**Physiological Alarm**] can be opened.

6. Prompt message area

It displays prompt messages, networking condition icons, and battery status icons, etc.

Please refer to Battery Chapter for battery status icons.



Wired network has been connected



Wired network connection failed



Central monitoring station connection connected



Central monitoring station connection failed



Battery status icon



Has been inserted into a U disk



Battery status icon

7. System time
Current system time
8. Waveform area
It mainly displays the waveform of physiological parameters, the name of each waveform is on the top left.
9. The area with waveforms
Consisting of several individual areas, displaying the measured value corresponding to each parameter model. The name of an individual parameter is on the top left of its area. The corresponding waveform of each parameter will be displayed in a same line.
10. The area without waveforms
For the parameters displayed in this area, the name of an individual parameter is on the top left of its area and its corresponding waveform will not be displayed.
11. Intelligent hot key area
It displays the intelligent hot keys, which are mainly used for some common operations.

Alarm status icon

	Means all alarms have been paused;
	Means the alarm has been reset;
	Means the alarm sound has been turned off;
	Means the alarm of a parameter has been turned off the system is in the status of alarm off;

2.4 Hot Key

Intelligent hot keys are some graphic hot keys displayed on the lower part of the main screen of monitor, it makes it convenient quick for you to call on some functions. The monitor can display the following intelligent hot keys:

	Main menu		Manual event
	Standby		Min-trend
	Data Review		Volume setup
	Alarm setup		Oxygen CRG
	NIBP measure		Viewbed
	Stop all measuring		Calculation
	Screen block		Unit setup
	Print		Alarm reset
	Freeze		Alarm pause
	Screen selection		12-lead ECG
	Load configuration		HRV analysis
	Privacy mode		Display setup

	Patient setup		Night mode
	ECG summary		More
	NIBP analysis		Record
	SPO ₂ analysis		Continous NIBP measure (NIBP status)
	NIBP setup		Fixed layout/Autp layout
	IBP zero calibration		

You can customize the hot keys displayed in the intelligent hot keys area.

1. Select [Main Menu] - [Interface] - [Hot Key] or click [More] in the hot key area.
2. In the [Hot Key Setup] window, according to your requirements, select a current hot key to be modified firstly and then select a settable hot key to load the hot key or sort order of the hot keys.

Chapter 3 Basic Operation

3.1 Installation



WARNING

- The device shall be Installed by the specified staff of our company.
 - The software copyright of the device belongs to our company. Any organization or person cannot perform infringement acts to change, copy or exchange it in any mean or form without permission.
 - All analog and digital equipment connected to this device must be certified by specified IBC standards (e.g. IEC 60950 Information Technology Equipment - Safety, and TEC 60601-1 Medical Electrical Equipment - Safety), and all equipment shall comply with the requirements of IBC 60601-1-1 (valid versions) for connection. The person who connects the additional equipment to the input/output port, is responsible for the compliance with the IBC 60601-1-1 standard. If you have any questions, please contact us.
 - When this device is connected to other electrical equipment in order to achieve a specific function, if the hazards of this combination cannot be determined from the specification of each equipment (for example, the risk of electric shock due to accumulation of leakage current), please contact our company or experts in the hospital related to this field ensure that necessary safety of all equipment in this combination will not be damaged.
 - Please use the designated bracket of Our company (optional). When installing the bracket, please avoid the screws touching the battery inside the machine.
-

3.2 Open the Package and Check

Before opening the package, please check it carefully. If any damage is found, please contact the carrier immediately. Unwrap the package following the right instructions. Carefully take out the device and other components from the packaging box and check them one by one according to the packing list. Check to see if the device has any mechanical damage or any part is missing. If there is any problem, please contact our company immediately.



WARNING

- Please keep the packaging materials out of the reach of children. The disposal of packaging materials should obey the local regulations or the hospital waste disposal system.
 - The device may get biological contaminated during storage, transport or use. Please make sure that the package is intact before use, especially the disposable accessories. If any damage is found, please don't use.
-

NOTE

- Keep the package and packing materials for possible future transportation or storage.
-

3.3 Open the Package and Check

The service environment of the device must be in accordance with the environmental specification requirements stated in this instructions.

The service environment of the device also needs to properly avoid noise, vibration, dust, corrosive or inflammable and explosive substance. If the device is installed in a cabinet, enough space has to be guaranteed in front of and back the cabinet so as to easily operate, maintain and repair; In order to keep the air circulated freely and achieve a good heat dissipation effect, at least 2 inches (5cm) interspace is required around the device.

When the device needs to be move to another environment, condensation may occur to the device because of the difference of temperature or humidity. At this time, the device shall not be used until the condensation is disappeared.



WARNING

- Please make sure that the device works in the stipulated environment requirements. Otherwise, it will not meet the technical specifications claimed in the instructions, and may cause to the device damaged and other unexpected results.
-

3.4 Preparation

3.4.1 Power on

You are able to monitor patients when the monitor has been installed completely.

1. Prior to powering on, check if there are some mechanical damages on the device, if the connection between the external cable and accessories is properly.
 2. Plug the power cord into the AC power port. If the device uses internal battery for power, please make sure that there is enough electric quantity in the battery.
 3. Press the power switch, the screen displays a startup picture and alarm light will light on in red and yellow respectively, and the system will make a beep sound.
 4. The startup picture disappears and the main interface is displayed.
-



WARNING

- If there is any damage on the monitor or it cannot work normally (such as display faults, including blank screen, blurred screen, no display contents, etc.), it shall not be used for patient monitoring. Please contact the maintenance personnel or our company immediately. (display failures such as blank screen, blurred screen, or no display content)

3.4.2 Start to Monitor

1. Connecting patient cables and sensors.
2. Check whether the patient cables and sensors are correctly connected.
3. Check whether the settings of monitor are correct, such as [PAT TYPE] and [Pacemaker]
4. For detailed information about the measurement and monitoring of each parameter, please refer to relevant chapters.

3.5 Power off

Turn off the monitor according to the following steps:

1. Confirm to close the monitoring on patients.
2. Disconnect the connection among the monitor cables, sensors, and patients.
3. Confirm to save or clean the monitoring data of patients.
4. Press the ON/OFF button down for two seconds to turn off the monitor.

CAUTION

- If the device can not be powered off normally or there are some special circumstances, you can press on the power switch for 10 seconds to shut down the device compulsorily. While the forced shutdown may cause loss of data on the device, which is not recommended.

3.6 Buttons to Use

The monitor has two different buttons:

- Soft button: The position where the cursor can be remained on the interface. It is convenient for you to access to some menu or execute some operation, mainly including:
 - ◆ Parameter hot key: Select the parameter area or waveform area of a parameter to enter its corresponding parameter setup menu.
 - ◆ Intelligent hot key: Users can customize the keyboard shortcuts at the lower part of the home screen, please see Intelligent Hot Key chapter for details.
- Pop-up key: A menu key related to tasks, which will appear on the monitor screen automatically when required. For example, the confirmation pop-up key appeared when you need to confirm modification.

3.7 Use Touch Screen

Directly clicking the touch screen can conveniently and quickly complete some operations. You can disable or enable the touch screen operation as required. Press on the hot key of [Main Menu] and remain for

three seconds to lock or unlock the screen. When the screen is locked, the hot key of the [Main Menu] displays icons.

3.8 Set Interface

Click the parameter area on the screen and select to close this area on the pop-up menu.

Click again the parameter area which has turned to blank and select the parameter required to be displayed to switch the display content in the parameter area.

Only parameter with waveform can be selected for waveform parameter area (ECG parameter area can not be closed).

Any parameter can be selected for the parameter area without waveform.

Modification of the quantity of parameter areas. If a modification is needed, please enter "Main Menu" - "Maintenance" - "User Maintenance" and input the user's maintenance password to enter the maintenance interface. Adjust the line number of the parameter area with waveforms and that without waveforms after entering the "Other Setup". Please properly adjust according to the screen size. If the information display is not complete after the adjustment, please restore to the previous line number in time.



WARNING

- The parameters which are not allocated with display area in the window of [Interface setup] will not be displayed on the interface of the monitor. The related alarm of the parameter still will be provided.

3.9 Use Menu



The style of all menus is similar to that of the main menu, which is consist of following parts:

1. Menu title: The summary to current menu.
2. The title of sub-menu and the entrance of all sub-menus.
3. Main display area of the main menu: Display button, click the display button to enter the corresponding sub-menu.
4. Button of Close: Exit from current menu.
5. Option menu, click to pop up the option menu and switch items by sliding up to down. Click the "Cancel" on the top left corner and close, the menu option will not take effect, click the "OK" on the top right corner and close, the menu option will take effect.
6. Switch, click it to switch ON/OFF.
7. Click the area beyond the menu window or quit button exit from menu

3.10 Measuring Setup

In the fixed layout mode, click the parameter area which has been opened on the screen and select "Close This Area" on the pop-up menu. The interface of the monitor will not display the parameter value and waveform of the parameter. Click the blank parameter area and select the parameter displayed to open the parameter module and display the content in the parameter area.

NOTE

- ECG parameter switch is always on fixedly and can not be set.

3.11 General Setup

This section only describes the general setup of the monitor, for the setup of parameter and other functions, please refer to the corresponding sections.

3.11.1 Define the Monitor

When installing the monitor or change the service environment of the monitor, the monitor shall be defined, the method for which is as below:

1. Select "Main Menu" - "Maintenance" - "User Maintenance" - input user maintenance password "70808".
2. Set [Name of Monitor], [Department], and [Bed Number] in the [User Maintenance] menu.

3.11.2 Set Language

1. Select [Main Menu] - [Maintenance] - [User Maintenance] -input user maintenance password.
2. Select [Language] in the [User Maintenance] menu as required.
3. Restart the monitor.

3.11.3 Adjust the Screen Brightness

1. Select [Main Menu] - [Interface] - [Display] or the hot key [Display Setup].
2. Select [Screen Brightness]: Auto, 1~10. 1 is the darkest and 10 is the brightest. If the device is battery powered, you can set a lower brightness to save the electric quantity of the battery. When the monitor is stand by, the screen brightness will be turned to the darkest automatically.

3.11.4 Set Date and Time

Select [Main Menu] - [User Maintenance] - [Change Time].
Set "Date" and "Time".

CAUTION

- Changing date and time will lead to program reinitialization, which will affect the trend and event storage, and may cause to loss of data.

3.11.5 Adjust Volume

Click "Volume Adjustment" hot key to start the volume adjustment menu.

1. Set "Alarm Volume": $X \sim 10$. X is the minimum volume, which is depended on the setup of the minimum volume (Please refer to [User Maintenance] - [Alarm Setup] - [The Minimum Alarm Volume]), 10 is the maximum volume.
2. Set "Medium-level alarm volume": $X \sim X+n$, X is "alarm volume", n is $0 \sim 4$.
3. Set "High-level alarm volume": $X \sim X+n$, X is "Medium-level alarm volume", n is $0 \sim 4$.
4. Heartbeat volume: The heartbeat volume is decided by the [Alarm Source] in the "ECG Setup" menu, which parameter (HR or PR) is set for the [Alarm Source], the heartbeat volume will sound according to the rhyme of the parameter. Select [Heartbeat Volume]: $0 \sim 10$. Select 0 is to turn off the heartbeat sound, 10 is the maximum volume.
5. Key-press volume: Select "Key-press Volume": $0 \sim 10$. Select 0 is to turn off the key-press sound, 10 is the maximum volume.

Chapter 4 Manage Patients

4.1 Admit Patients

The monitor can display and store the physiological data of a patient when the patient has been connected to the monitor, namely the patient can be monitored without admitting the patient.

But the data of the patient who is not admitted is only effect during this start-up process and there is no historical records generated when the device is powered off. Therefore, it is very important to execute the operation of admitting patients. Please attach importance to this operation.

When the monitor has admitted a patient, it is recommended to remove the current patient first prior to monitoring the next patient (unadmitted). Otherwise, the date of the next patient will be stored in the data of the current patient.

Following steps must be taken to admit a patient:

1. Select [Patient Management] hot key, or select [Main Menu] - [Patient Management].
2. Select [Admit Patient]. If the monitor has admitted a patient, please select [OK] to remove the current patient. If the monitor has not admitted any patient, the following options can be selected:
 - ◆ [Yes]: Apply the data that the monitor has stored to this patient.
 - ◆ [No]: Clean up the stored data.
3. Input or select all information of a patient in the [Patient Information] menu, especially:
 - ◆ [Patient Type]: It decides the algorithms which are used to process and calculate some measurement for the monitor, and the secure limit and alarm limit range which are applicable for some measurement.
 - ◆ [Pace-making]: It decides whether the monitor display pacemaker pulse mark, when it is set to [No], the pacemaker pulse mark will not be displayed on the ECG waveform.
4. Select [OK].



WARNING

- No matter whether a patient has been admitted, the system will assign the [Patient Type] and [Pace-making] a default value, users must confirm whether to apply this default value to the patient monitored.
- For pace-making patients, [Yes] must be selected for [Pace-making]. Otherwise, the pace-maker pulse will be taken as a regular QRS complex, and if the ECG signal is too weak, the system cannot detect it and alarm.
- For non-pace-making patients, [No] must be selected for [Pace-making].

4.2 Quickly Admit Patients

In case of emergency, you may have no enough time to input detailed information. At this time, you can adopt the mode to quickly admit a patient. Later on, you must supplement other information of the patient completely.

Otherwise, the patient information area will always display the  icon, the information not input will not be in the record result and will not be saved.

1. Select [Patient Management] hot key, or select [Main Menu] - [Patient Management].
2. Select [Quickly Admit Patient], If the monitor has admitted a patient, please select [OK] to remove the current patient. If the monitor has not admitted any patient, the following options can be selected:
 - ◆ [Yes]: Apply the data that the monitor has stored to this patient.
 - ◆ [No]: Clean up the stored data.
3. Set [Patient Type] and [Pace-making], and then select [OK].

4.3 Inquire and Acquire Patient Information

The monitor can acquire the patient information on the HIS system through network interface and display it on the monitor. You can inquire and acquire the patient information on the HIS system through the following steps:

1. Select [Main Menu] - [User Maintenance] - Input the [IP address] and [Port] of the network interface.
2. Click the patient information area to enter the [Patient Information] menu.
3. Click the button of [Patient Information Acquisition] and a [Patient Information Acquisition] menu is popped up.
4. Input the query condition and click the button of [Inquire] to display the patient information.
5. Select a patient from the patient information list and the corresponding patient information in the monitor will be updated.

4.4 Edit Patient

When the monitor has admitted a patient, but the patient information is not complete or needs to be modified:

1. Select [Patient Management] hot key, or select [Main Menu] - [Patient Management].
2. Select [Patient Information], and then change it as required in the pop-up menu.
3. Select [OK].

4.5 Remove Patients

Following steps must be taken to remove a patient:

1. Select [Patient Management] hot key, or select [Main Menu] - [Patient Management].
2. Select [Remove Patients].

NOTE

- The operation to remove a patient will delete all waveform data of the patient in the monitor
-

4.6 Central Monitoring System

The monitor can be connected to the central monitoring system. Through network:

- The monitor sends patient information, real-time monitoring or measuring data, alarm limit, alarm-level, alarm information, prompt messages, and various setups to the central monitoring system.
- The central monitoring system will make a synchronous display with the monitor and perform a bilateral control for some functions. For example: Changing patient information, admitting patients, removing patients, starting or stopping NIBP measuring, etc.

Please refer to the Operation Instruction of the Central Monitoring System for details.

Chapter 5 Configuration Management

5.1 Introduction

When carrying out a continuous monitoring on a patient, medical staff generally need to adjust some setups of the monitor according to the patient's actual situation. All these setup combinations which can operate the monitor is called a configuration. For configure the monitor more effectively and quickly, the monitor provides a whole set of monitor configuration for you to use according to the requirements for different patient types, and the actual clinical requirements of different departments. You can also change some setup items in a configuration according to the actual requirements and save as a self-defined user configuration.

The default monitor configuration provided by us is classified according to actual clinical departments. You can choose:

- General monitoring (General)
- Surgery/Anesthesia monitoring (OR)
- Intensive Care monitoring (ICU)
- Newborn Intensive Care Monitoring (NICU)
- Cardiac Intensive Care monitoring (CCU)

In which, each department respectively includes the configurations for adults, pediatric, and neonate.



WARNING

- **The function of Configuration Management is password protected, which must be operated and confirmed by professional clinical medical staff.**

The system configuration information of the monitor mainly includes:

- Parameter configuration item

All setup items which are related to measuring parameters, such as waveform gain, alarm switch and alarm limit setup, etc.

- General configuration item

Other setup items which stipulate the work mode of the monitor except for the parameter configuration item, such as interface deployment, record, print, alarm setup, etc.

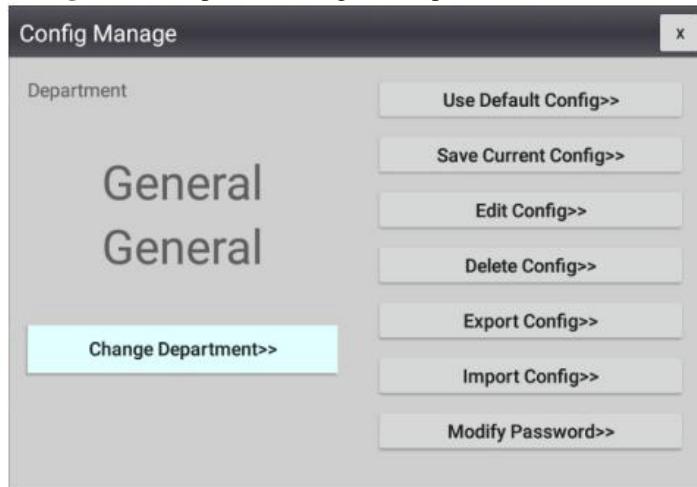
- Maintenance item

The contents related to the user maintenance function, such as unit setup, time and data format setup, etc. Please refer to the Appendix D Information for the important configuration items, its default value and the maintenance items as well.

5.2 Enter the Configuration Management Menu

For entering the configuration management menu:

1. Enter the [Main Menu] - [Configuration] - [Configuration Management] - Input the configuration password.



5.3 Change Department

If the one you want to browse is not current department configuration, you can select [Change Department >>] under the main menu of configuration management, and select the corresponding department that you want to configure.

5.4 Select Default Configuration

Default configuration refers to the configuration that is loaded automatically by the monitor in following situations: admitting patients, removing patients, cleaning patient data, and changing patient type.

The default configuration can be the latest configuration and also can be the manufacturer configuration or user configuration. The following steps must be taken for setting default configuration:

1. In the main menu of configuration management, select [Select Default Configuration >>].
2. In the menu of [Select Default Configuration], select [Use the Latest Configuration] or [Use the Specified Configuration].

When the [Use the Specified Configuration] is selected, the monitor will decide to restore the configuration of adults, pediatric and neonate according to the patient type. The configuration can be selected as a manufacturer configuration or a user configuration which has been saved.

Taking adults as the example: Select the drop-down box on the right of the [Adult Default] and select [Default Configuration] or some user configuration in the list.

5.5 Save Current Setup

You can save the current setup of the monitor as a user configuration. 10 user configurations at most can be saved. When you saving the 11th user configuration, the first one saved will be deleted by default.

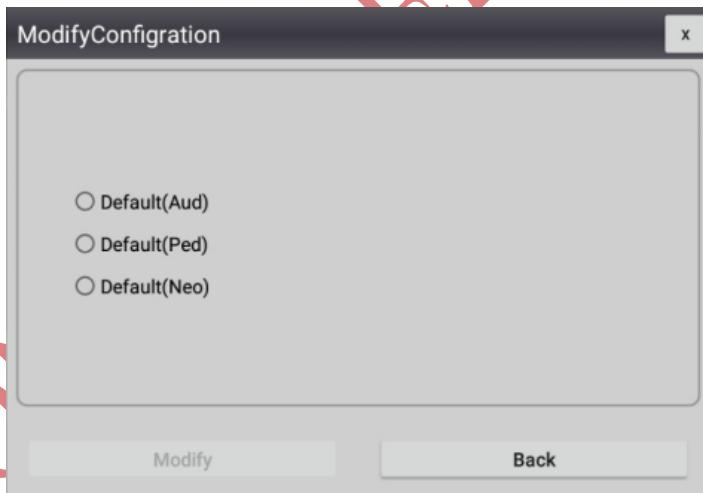
The following steps must be taken to save current setup:

1. In the main menu of configuration management, select [**Save Current Configuration >>**].
2. In the pop-up dialog box of [**User Configuration Saving**], input the name of the configuration and click [**OK**].

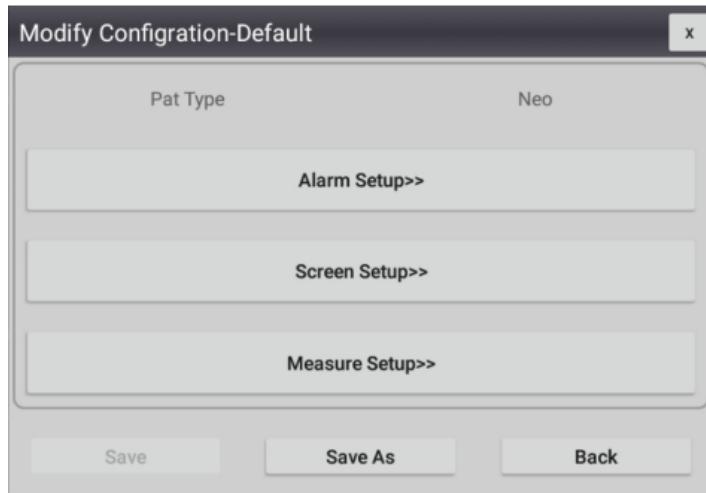
5.6 Edit Configuration

For editing configuration:

1. In the main menu of configuration management, select [**Edit Configuration >>**]



2. The current existed configuration on the monitor is displayed in the pop-up menu. Select the configuration which is required to be edited and click the button of [**Edit**].



3. Select [Alarm Setup >>], [Interface Setup >>] or [Measurement Setup >>] in the pop-up menu to enter the corresponding setting menu. The contents of all setup items can be changed as required. After the setup items in the alarm setup has been changed, the content change will be marked in red font.
4. It returns to the Edit Configuration Menu when the change is completed. You can select [Save] or [Save as] to save your modified configuration. The original configuration will be covered if you select [Save]. The modified configuration can be saved as a configuration with another name by selecting [Save as].



WARNING

- Default configuration cannot be changed.

5.7 Delete Configuration

You can delete the user configuration which has been saved.

1. In the main menu of system configuration, select [**Delete Configuration >>**].
2. The current existed user configuration on the monitor is displayed in the pop-up menu. Select the configuration which is required to be deleted and click the button of [**Delete**].
3. Select [**Yes**] in the pop-up dialog box.

5.8 Configuration Transferring

The monitor provides the function of configuration transferring. You can use an external storage device to quickly copy the user-defined configuration on the monitor to another monitor which is required to be set similarly, so as to omit the tedious procedures to reset one by one, which is convenient for medical staff to operate. At present, we only support to transfer the monitor configuration by U disks.

The following steps must be taken to export the current user configuration of the monitor:

1. Plug the U disk into the monitor.
2. In the main menu of system configuration, select [**Export Configuration>>**].
3. Select the configuration and the user maintenance items which are required to be exported in the pop-up menu, and then click [**Export**].

The following steps must be taken to import the user configuration into the monitor:

1. Plug the external storage device which has saved the configuration files in it into the target monitor.
2. In the main menu of system configuration, select [**Import Configuration>>**].
3. Select the configuration and the user maintenance items which are required to be imported in the pop-up menu, and then click [**Import**].

5.9 Change the Password

You can change the configuration password.

1. In the main menu of system configuration, select [**Change Password>>**].
2. Input a new password in the pop-up menu and click [**OK**].

5.10 Load Configuration

In routine operation, you possibly change some setups under some special situations, which may not proper or correct. Or the configuration selected before is not suitable for the new admitted patient. Therefore, we provide the function of loading configuration so as to ensure that all setups of the monitor are applicable for the patient being monitored.

The following steps must be taken to load a configuration:

1. Enter the [**Main Menu**] - [**Configuration**] - [**Load Configuration**].
2. The current existed configuration on the monitor is displayed in the pop-up menu.
3. Select the configuration required to be loaded in the pop-up menu.
4. Click the button of [**Load**] to load this configuration.

Chapter 6 User Interface

6.1 Setting the style of interface

Users can set the interface style as required, including:

- The width of waveform line
- The display color of parameter and waveform
- The parameter that needs to be monitored

Some risks may exist in the change of some settings, so it is protected by password. The staff who changes it must have authority. After change, please notice the monitor user.

6.1.1 The width of line

1. Select [Major Menu] - [Interface] - [Display]
2. Set [Waveform Style] as [Thick Line], [Thin Line]

6.1.2 Color

1. Select [Major Menu] - [Interface] - [Parameter Color].
2. Select the color frame on the right side of a waveform/parameter, and select needed color in the pop-up menu.

6.1.3 Change the Interface Layout

Select [Interface Selection] hot key, or [Main Menu] - [Interface] - [Interface Selection], and enter into [Interface Selection] menu:

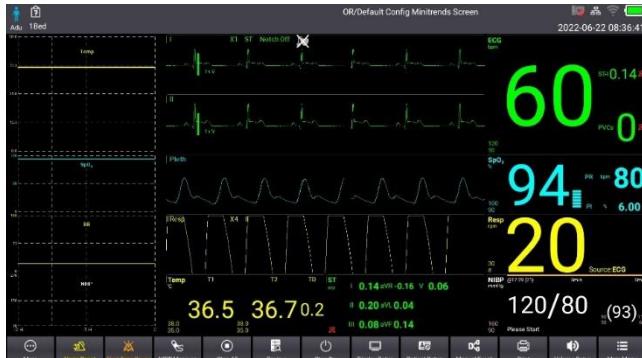
- Users can select needed interface type in the menu of [Interface Selection]
- Click the parameter display area in the main interface, and all the parameter areas in the interface and content displayed in waveform area can be set accordingly.

6.2 Observe Dynamic Short Trend

6.2.1 Open Dynamic Short Trend

One of the following options can be selected to open the dynamic short trend:

- Select [Short Trend] hot key.
- Select [Interface Selection] hot key- [Trend Coexistence Interface]
- Select [Main Menu] - [Interface] - [Interface Selection] - [Trend Coexistence Interface]



Dynamic short trend is on the left side of waveform area, which displays the trend of a series of parameters within the latest period of time. The name of the parameter is displayed above the Trend Graph and the scale is displayed on its left side. The time is displayed on the bottom of Dynamic Trend Interface.

6.2.2 Set Up Short Trend

Select the area of trend graph and the following items can be selected in the pop-up [Short Trend Setup] menu:

- Select the parameter that needs to be displayed.
- Select [Dynamic Trend Time], and then select an appropriate time.

6.3 Observe oxyCRG Graph

The following method can be used to enter into oxyCRG Graph:

- Select [oxyCRG] hot key.
- Select [Interface Selection] hot key- [oxyCRG Interface]
- Select [Main Menu] – [Interface] – [Interface Selection] - [oxyCRG Interface]



oxyCRG Screen covers lower part of the waveform area, it consists of HR Trend, SpO₂ Trend, RR Trend and Compressed Waveform (CO₂ waveform or Respiration Waveform) Click this area to display the setup interface of oxyCRG:

1. OxyCRG Event
Click and enter into [Recall] menu.
2. The duration of trend time
The time duration that can be selected: [1 min], [2 min], [4 min] or [8 min].
3. Display Setup
The displayed parameter, storage time of events and scale of waveform of oxyCRG Graph can be set manually.
4. Automatic Scale
The scale can be adjusted to the most appropriated status automatically.
5. Record
The current displayed oxyCRG Graph will be output through monitor.
6. Print
The current displayed oxyCRG Graph will be printed out by printer.

6.4 Viewbed Observation

6.4.1 Viewbed Integration

The patient monitor can make up of "Viewbed Integration" by selecting connected viewbed monitors of CONTEC TS series. It can select a maximum of 10 sets of viewbed monitors.

1. One of the following methods will be adopted to open the observation window for viewbed:
 - Select [Viewbed Observation] hot key.

- Select [Interface Selection] hot key- [Viewbed Observation Interface].
 - Select [Main Menu] – [Interface] – [Interface Selection] - [Viewbed Observation Interface].
2. Select [Setup] in the [Viewbed Observation] window.

The connected monitors that need to be observed in the pop-up list will be selected and then select button.

6.4.2 Viewbed Integration Column



This column is located at the bottom of [Viewbed Observation] window, displays administrative office and bed number that relate to each viewbed monitor and indicates status with different colors,

- Red: Means the monitor is making a high level physiological alarm.
- Yellow: Means the monitor is making a middle or low level physiological alarm.
- Grey: Means the monitor does not make physiological alarm.

The following steps can be taken to select some monitors in the Viewbed Integration Column:

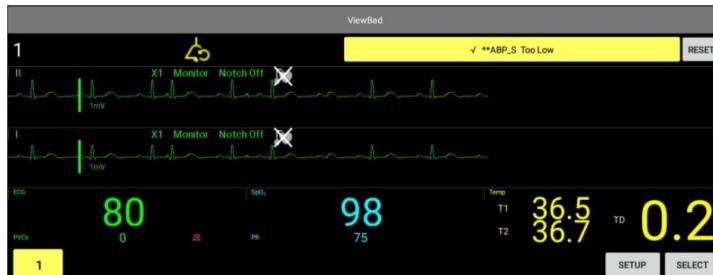
- Observing the occurring physiological alarm on this monitor,
- Select [Observe the Patient on This Bed], then the monitor can be observed.

Please refer to the Alarm chapter for more details about viewbed alarm.

6.4.3 Viewbed Observation Window

The monitor will select one of the viewbed monitor manual to observe when viewbed observation window is opened first time. The Viewbed observation window covers the lower part of waveform area and is consisted of following information:

1. Information line: Displays the administrative office, bed number, patient name, type of patient, alarm status icon and network condition icon.
2. Observation area: Displays some waveforms and parameters of viewbed monitor.
3. Viewbed Integration Column
4. Viewbed Information Area: Displays physiological alarm. When this area is selected, [Alarm Message List] can be entered, and all the physiological alarm information occurs to the viewbed can be observed accordingly.



In addition, users can select waveforms and parameters that need to be observed according their needs.

- Click "Set" to enter its setting interface, then select the waveform name and parameter name to be observed.



WARNING

- The case of data delay will come to the viewed observation window. Do not rely on the Viewbed Observation Window to obtain the real time data.

6.5 Big Character Interface

To enter the big character interface:

1. Select [Interface Selection] hot key, or [Main Menu] - [Interface] - [Interface Selection]
2. Select [Big Character Interface]



Users can select six parameters to observe in the [Big Character Interface Setup] window in [Interface Layout] menu based on their needs. For the parameter with waveform, a line of waveform will be displayed simultaneously.

6.6 Other Interfaces

After selecting "7-Lead ECG/7-Lead Half Screen/12-Lead ECG", the corresponding ECG waveform will be displayed in the waveform area.

6.7 Waveform freeze

During the process of patient monitoring, medical staff can freeze waveform firstly and then observe it in details, select [Waveform Freeze] hot key so that recall of waveform after freeze can be conducted and some waveform after freeze can be input to the recorder. Select the waveform freeze hotkey again to cancel the freeze. The freeze function of this monitor has following characteristics:

- Freeze status may occur at any one of the interfaces.
- When it comes to the freeze status, the system will exit from all other operation menus, and meanwhile it will freeze all the waveforms in waveform area in the basic interface.
- Record and recall can be done to the freeze waveform

Chapter 7 Alarm

Alarm means when the vital signs of patient who are receiving monitor are abnormal or monitor malfunction leads to unsmooth progress of the monitor, medical staff will receive prompt aural and visual message from the monitor.



WARNING

- In any single area (such as Intensive Care Unit or Cardiac Operating Room), potential risks exist when the same or similar equipment uses different alarm preset.
- If monitor connects to the central monitor system, then potential risks may exist in alarm pause, prohibition, silence and reset operation in the monitor. Please refer to instruction of central monitor system for more details.

7.1 Type of Alarm

According to the characteristics of alarm, it can be divided into physiological alarm and technical alarm.

1. Physiological Alarm

Physiological alarm is often caused by the fact that patient's some physiological parameters are out of the high and low limit of setup alarm, or patient's physiology is abnormal. Physiological alarm messages will be displayed in the physiological alarm area.

2. Technology Alarm

Technology alarm is called system error message, it refers to the alarm triggered by the situations that some monitor functions cannot be operated due to incorrect operation or system failure or unreality of monitor result. Technical alarm messages will be displayed in the technical alarm area. In addition to physiological alarm and technical alarm, some messages that relate to system status or patient state will be displayed on the monitor screen. The prompt messages are often displayed.

In technological alarm area and prompt message area, the prompt messages that relate to arrhythmia will be displayed in physiological alarm area. Besides, there are some other prompt messages are displayed in the parameter area, for instance: The prompt messages that relate to NIBP will be displayed in NIBP parameter area.

7.2 Alarm Level

According to the seriousness of alarm, it can be devided into High Level Alarm, Middle Level Alarm, and Low Level Alarm.

	Physiological Alarm	Technology Alarm
--	---------------------	------------------

High Level Alarm	When the patient's state is critical, and is in mortal danger, rescue must be done immediately, such as arresting, ventricular fibrillation/ventricular tachycardia etc.	Severe machine malfunction or misoperation may lead to failure monitor on patient's critical state and life risk, such as low power of battery.
Middle Level Alarm	When patient's physiological is abnormal, the relevant act or rescue must be taken immediately.	Some malfunction or misoperation may not threat to patient's safety, but it will make impact on the normal monitor on the key physiological parameters.
Low Level Alarm	When patient's physiology is abnormal, the relevant act or rescue is likely to be taken.	Malfunction misoperation may lead to abnormal of some monitor function, but it is not a threat to patient's safety.

7.3 Alarm Mode

When it alarms, the monitor will adopt aural or visual alarm in the following to remind users:

Light Alarm

Alarm messages

Parameter flickering

Sound Alarm

Different alarm levels of Light Alarm, Sound Alarm and Alarm Messages will be distinguished with different methods.

7.3.1 Light Alarm

When technology alarm or physiological alarm occurs, the alarm light will mark different levels of alarm by showing different colors and flickering frequency.

- High level alarm: Red and fast flickering frequency of 2Hz
- Middle level alarm: Yellow and slow flickering frequency of 0.66Hz
- Low level of physiological alarm: Yellow, remain bright and no flickering.
- Low level of technological alarm: Yellow, remain bright and no flickering

7.3.2 Alarm Message

Alarm message refers to the situation that when alarm is sounded, the physiological alarm area and technological alarm area in the monitor will release the related alarm message. For the Physiological alarm, the following marks will be used at the front of alarm message to distinguish different levels of alarm:

- High level alarm: *
- Middle level alarm: **
- Low level alarm: *

And system still uses different grounding to distinguish the level of physiological and technological alarm:

- High level alarm: Red
- Middle level alarm: Yellow
- Low level alarm: Yellow

Alarm message can be checked when selecting the physiological alarm area or technological alarm area.

7.3.3 Parameter Flickering

When patient's some physiological parameter triggers alarm, this parameter in the parameter area will shine at the frequency of one time per second, and the high limit and low limit of this parameter will shine at the same frequency accordingly, that means this parameter has surpass its high limit or low limit.

7.3.4 Sound Alarm

Sound alarm means when alarm occurs, monitor will use different voice characteristics to remind different levels of alarm. The alarm voice is different from the voice frequency of heartbeat, the sound of pulse, the voice of pressing button so that users can tell them apart.

High level alarm: Beep-Beep-Beep-Beep-----Beep-Beep-Beep--Beep-Beep. The frequency is adjustable within range of 2.5~5, and interval of 0.5s.

Middle level alarm: Beep-Beep-Beep. The frequency is adjustable within range of 5~15s, and interval of 0.5s.

Low level alarm: Beep. The frequency is adjustable within range of 15~100s, and interval of 1s.

NOTE

- When many different levels of alarms occur at the same time, the monitor will release light and voice alarm based on the highest level of all the current alarms

7.3.5 Icons of Alarm Status

Besides the alarms above, the following alarm icons will be showed in the screen to indicate different status of alarm.



Indicates that all the alarms are paused;



Indicates that all the alarms are reset;



Indicates that all the voice of alarms are turned off;



Indicates that the alarm for a parameter is turned off or the system is in the status of alarm off.

7.4 Setup Voice of Alarm

7.4.1 Set the minimum alarm volume

1. Select [Main Menu] - [Maintenance] - [User Maintenance] – Input User Maintenance Password
2. Select [Alarm Setup>>] and enter [Alarm Setup] menu.
3. Select [Minimum Alarm Volume], range is between 0~10.

The minimum volume decides the minimum value of alarm volume setup. And it is not affected by user's default configuration or factory's configuration. When the monitor is shut off or restart, the setup of minimum volume of alarm will not change.

7.4.2 Set of alarm volume

1. Select [Voice Adjustment] hot key or [Alarm Setup] hot key- [Other], or [Main Menu] - [Alarm] - [Other].
2. Setup "Volume of Alarm": X~10. X is the minimum volume, it depends on the setup of minimum volume of alarm (Please refer to [User Maintenance] - [Alarm Setup] - [Minimum Alarm Volume] for the minimum alarm volume), 10 is the maximum alarm volume.
3. Set "Middle Level of Alarm Volume": X~X+n, X is "The Volume of Alarm", n is 0~4.
4. Set "High Level of Alarm Volume": X~X+n, X is "The Middle Level of Volume of Alarm", n is 0~4.

7.4.3 Interval of Alarm Voice

1. Select [Main Menu] - [Maintenance] - [User Maintenance] - Input User Maintenance Password
2. Select [Alarm Setup] and enter [Alarm Setup] menu.
3. Setup voice intervals of high level, middle level and low level alarm.

**WARNING**

- While the alarm voice is off, the monitor won't alarm even if a new alarm is triggered. Hence, users must carefully select whether shut down alarm voice.
- Instead of relying on the Voice Alarm System to monitor patient only. Adjusting the volume of alarm lower may bring risk to patient. User should pay closely attention to patient's actual clinical status.

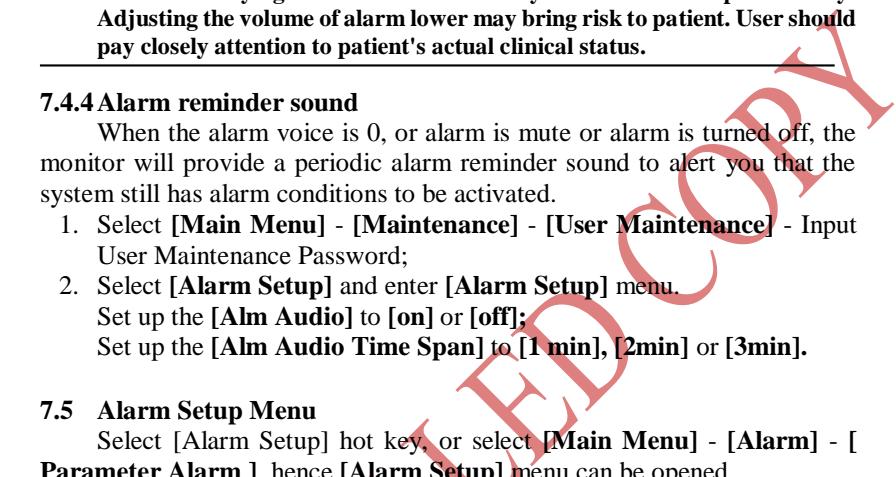
7.4.4 Alarm reminder sound

When the alarm voice is 0, or alarm is mute or alarm is turned off, the monitor will provide a periodic alarm reminder sound to alert you that the system still has alarm conditions to be activated.

1. Select [Main Menu] - [Maintenance] - [User Maintenance] - Input User Maintenance Password;
2. Select [Alarm Setup] and enter [Alarm Setup] menu.
Set up the [Alm Audio] to [on] or [off];
Set up the [Alm Audio Time Span] to [1 min], [2min] or [3min].

7.5 Alarm Setup Menu

Select [Alarm Setup] hot key, or select [Main Menu] - [Alarm] - [Parameter Alarm], hence [Alarm Setup] menu can be opened.



Alarm Setup						
Parameter	ST Alarm	Arr Analysis	Arr Threshold	Other		
ECG	HR(bpm)	<input checked="" type="checkbox"/>	120	50	Med	<input type="checkbox"/>
QT	QTc(msec)	<input type="checkbox"/>	500		Med	<input type="checkbox"/>
SpO ₂	ΔQTc(msec)	<input type="checkbox"/>	60		Med	<input type="checkbox"/>
RR	SpO ₂ (%)	<input checked="" type="checkbox"/>	100	90	Med	<input type="checkbox"/>
Temp	PR(bpm)	<input checked="" type="checkbox"/>	120	50	Med	<input type="checkbox"/>
NIBP	RR(rpm)	<input checked="" type="checkbox"/>	30	8	Med	<input type="checkbox"/>
	T1(°C)	<input checked="" type="checkbox"/>	38.0	35.0	Med	<input type="checkbox"/>
	T2(°C)	<input checked="" type="checkbox"/>	38.0	35.0	Med	<input type="checkbox"/>
	TT(°C)	<input checked="" type="checkbox"/>				
<input type="button" value="Auto Alarm Limit"/>		<input type="button" value="Default Limit"/>				

The following operations can be done by users in this menu:

- Set the alarm properties for all the parameters;
- Set ST alarm;
- Set alarm for all the arrhythmia;
- Set parameter threshold value for partial arrhythmia;
- Set other items.

Please refer to Chapter ECG for how to set ST alarm, how to set alarm for all the arrhythmia and how to set parameter threshold value for partial arrhythmia.

7.5.1 Set up Alarm Parameter

Select [Main Menu] - [Alarm] - [Parameter Alarm], users can check and correct the alarm switches status of all parameters, high and low limit of alarm, level of alarm and alarm record switch status. When a parameter triggers the alarm, only the parameter's [Alarm Switch] and [Alarm Record] is [ON], the alarm will trigger the recorder to output the waveform and all the values of parameter that relate to alarm.



WARNING

- Please check whether the limit of alarm setup is suitable for the patient or not before monitoring.
 - Setting the limit value as ultimate value may lead to failure of alarm system. For example, high level of oxygen will make infants get posterior crystalline fiber hyperplasia, if high level of alarm for SpO₂ is set as 100%, which is equivalent to disconnect the high limit alarm.
-

7.5.2 Automatic Setup of Alarm Limit

The monitor provides an automatic setup of alarm limit function, it can set alarm limit value quickly based on measurement result of vital sign from patient. Start this function and monitor will calculate new high and low alarm limit value by following the latest result and each measurement value plus deviation.

In order to get automatic alarm limit value, users need a baseline which can collect a group of initial vital signs measurement value from patient. Then select [Alarm] - [Parameter Alarm] – [Automatic Alarm Limit] in the main menu, monitor will create new high and low limit of alarm limit based on the existed measurement results.

Before the application of automatic creation of alarm limit value, please confirm whether they are suitable for the current patients, if not, you have to set up alaum limit value manually. These limit value will remain until you reset them or change them manually.

The rules for the automatic alarm limit are demonstrated as following pictures.

Module	Alarm Parameter	Low Limit: Adults/Children	Infants	High Limit: Adults/Children	Infants	Allowable range for automatic alarm setting
ECG	HR /PR	(HR x 0.8) or 40 bpm, select high value	(HR – 30) or 90 bpm, select high value	(HR x 1.25) or 240 bpm, select low value	(HR+40) or 200 bpm, select low value	Adults/Children: 35~240 Infants: 55~225
Resp	RR	(RR x 0.5) or 6 rpm, select high value	(RR – 10) or 30 rpm, select high value	(RR x 1.5) or 3 rpm, select low value	(RR+25) or 85 rpm, select low value	Adults/Children: 6~55 Infants: 10~90
NIBP	NIBP-S	(SYS x 0.68 + 10) mmHg	(SYS – 15) or 45mm Hg, select higher value	SYS x 0.86 + 38 mmHg	(SYS + 15) or 105mm Hg , select lower value	Adults: 45~270 Children: 45~185 Infants: 35~115
	NIBP-D	(Dia x 0.68 + 6) mmHg	(Dia – 15) Or 20 mmHg, select higher value	(Dia x 0.86+ 32) mmHg	(Dia + 15) Or 80mmHg,select lower value	Adults: 25~225 Children: 25~150 Infants: 20~90
	NIBP-M	(Mean x 0.68 + 8) mmHg	(Mean - 15) or 35mm g, select higher value	Mean x 0.68 + 35 mmHg	(Mean + 15) or 95 mmHg, select lower value	Adults: 30~245 Children: 30~180 Infants: 25~105

Temp	T1	(T1 - 0.5)°C	(T1 - 0.5)°C	(T1 + 0.5)°C	(T1 + 0.5)°C	(1 ~49)°C
	T2	(T2-0.5)°C	(T2 - 0.5)°C	(T2+0.5)°C	(T2 + 0.5)°C	(1 ~49)°C
	TD	Same to the default alarm limit value	Same to the default alarm limit value	Same to the default alarm limit value	Same to the default alarm limit value	Same to the range of measurement
IBP; ART/ Ao/ UAP/ BAP/ FAP/ LV/ P1-P4 (Arterial Pressure)	IB P-S	(SYSx0.68 +10) mmHg	(SYS - 15) or 45mmHg, select high value	(SYSx08638) mmHg	(SYS + 15) or 105mm Hg, select low value	Adults: 45~270 Children: 45~185 Infants: 35~115
	I B P - D	(Dia x 0.68+ 6) mmHg	(Dia - 15) or 20mm Hg, select high value	(Dia x 0.86+ 32) mmHg	(Dia + 15) or 80mm Hg, select low value	Adults: 25~225 Children: 25~150 Infants: 20~90
	I B P - M	(Mean x 0.68 +8)mmHg	(Mean - 15) or 35mm Hg, select high value	(Mean x 0.86 + 35) mmHg	(Mean + 15) or 95mm Hg, select low value	Adults: 30~245 Children: 30~180 Infants: 25~105
PA	IB P-S	SYS x 0.75	SYS x 0.75	SYS x 1.25	SYS x 1.25	3 ~ 120 mmHg
	IB P-D	Dia x 0.75	Dia x 0.75	Dia x 1.25	Dia x 1.25	

	IB P- M	Mean x 0.75	Mean x 0.75	Mean x 1.25	Mean x 1.25	
IBP: CVP/I CP/ LAP/ RAP/ UVP/ P1-P4 (Veno us pressur e)	I B P - M	Mean x 0.75	Mean x 0.75	Mean x 1.25	Mean x 1.25	3~40mmH g
CO2	Et C O 2	0 ~ 32 mmHg: No Change	0 ~ 32 mmHg: No Change	0~32m mHg: No Change	0 ~ 32 mmHg: No Change	Same as the range of measurem ent
		32 ~ 35 mmHg: 29 mmHg	32 ~ 35 mmHg : 29 mmHg	32 ~ 35 mmHg: 41 mmHg	32 ~ 35 mmHg : 41 mmHg	
		35 ~ 45 mmHg: (etC02 - 6) mmHg	35 ~ 45 mmHg :(etC02 - 6) mmHg	35 ~ 45 mmHg: (etC02 + 6) mmHg	35 ~ 45 mmHg :(etC02 + 6) mmHg	
		45 ~ 48 mmHg: 39 mmHg	45 ~ 48 mmHg : 39 mmHg	45~48 mmHg: 51mmHg	45 ~ 48 mmHg: 51 mmHg	
		>48m mHg: No Chang e	>48mm Hg: No Change	>48mmHg: No Change	>48mm Hg: No Change	
	Fi C0 2	Irrelevant	Irreleva nt	Same to the default alarm limit value	Same to the defaut alarm limit value	Same as the range of measurem ent

	aw RR	awRR x 0.5 or 6rpm, select high value	(awRR -10) or 30rpm, select low value	awRR x 1.5 or 30rpm, select low value	(awRR) + 25) or 85rpm, select low value	Adults/Chil dren: 6 ~ 55 Infants: 10~90
--	----------	--	--	---	---	---

7.5.3 Set the Delay Time of Alarm

For the continuous measurement over-limit alarm, Time can be set in [Other] window in [Alarm Setup] menu. If the condition which triggers the alarm disappears within delay time, monitor will not sound alarm. The setup of delay time of alarm is not apply to the following physiological alarm:

- Respiratory Suffocation
- ST Alarm
- Arrhythmias alarm
- Weak ECG signal
- Resp heartbeat disturbance
- The limit of low saturability of SpO₂
- Pulse not detected
- Non-continuous measurement parameter over-limit alarm
- HR over-limit alarm

The time for [Suffocation Delay] and [ST Alarm Delay] can be set individually in [Other] window in [Alarm Setup] menu.

7.5.4 Set SpO₂ Technological Alarm Delay Time

The time of [Technological Alarm Delay] can be set in the window of [Other] in the menu of [Alarm Setup]. The setup items are [Off], [5s], [10s], [15s].

The setup delay time is effective in the following technological alarms: Falling off of SpO₂: sensor, Hard SpO₂ Bias Light, Extreme Weak Signal SpO₂, SpO₂ Disturb.

7.5.5 Set Length of Waveform

Select [Waveform] in the window of [Other] in the menu of [Alarm Setup], can be set as:

- [8s] : The 4s waveform before or after the occurrence time of alarm storing parameter or of manual events.
- [16s] : The 8s waveform before or after the occurrence time of alarm storing parameter or of manual events.

- [32s]: The 16s waveform before or after the occurrence time of alarm storing parameter or of manual events.

7.5.6 Cannula Mode

During the process of cannula in general anesthesia surgery, cannula mode can be used to reduce unnecessary alarm. Resp and CO₂ module support cannula mode, there is a **[Cannula Mode]** button in the parameter setup menu that relate to these parameters. When the **[Cannula Mode]** is selected, the physiological alarm for corresponding parameters will be shielded.

Users can set cannula mode time based on their needs, the default time is 2 minutes.

1. Select **[Main Menu] - [Maintenance] - [User Maintenance]** - Input User Maintenance Password
2. Select **[Alarm Setup>>]**, and set **[Cannula Mode Time]** as **[1min], [2min], [3min]** or **[5min]** in pop-up menu.

7.6 Pause Alarm



Press Pause Alarm  hot key, all physiological alarm indication in the monitor will be paused

- All the visual and audible alarm will be paused.
- Parameter and high limit/low limit of triggered physiological alarm stop flickering.
- Text messages of physiological alarms will not be displayed.
- The remaining time of the alarm pause will be displayed in physiological alarm
-  icon will be displayed in the alarm status icon area.

Users can set alarm pause time based on their needs, the default time is 2 minutes.

1. Select **[Main Menu] - [Maintenance] - [User Maintenance]** - Input User Maintenance Password.
2. Select **[Alarm Setup>>]**, set appropriate time for **[Alarm Pause Time]** in the pop-up menu.

7.7 Alarm Off

When **[Alarm Pause Time]** is set as **[Infinite]**, press alarm pause hot key, and the monitor comes to the status of Alarm Off

- Both the occurring visual alarms and audible alarms for physiological alarm are turned off.

- Parameter and high limit/low limit of triggered physiological alarm stop flickering.
- Text alarm messages of the physiological alarm will not be displayed
- **[Alarm Pause Forever]** will be displayed in physiological alarm area, the grounding colour is red.
- The audible alarm for the occurring technological alarm is turned off, but the visual alarm and text alarm messages remain unchanged.
-  icon will be displayed in audible icon area.

Users can press alarm pause hot key exist status of alarm off.



WARNING

- **Alarm Pause and Off** may bring risks to patients, so please handle it carefully.

7.8 Alarm Reset

By pressing  button, all the occurring alarms in the monitor can be reset and kept silence. The visual and audible alarm for this alarm will be eliminated,

and “” icon will be displayed in alarm icon area. When the physiological alarm is silenced, the text alarm message with a “√” ahead of it indicate that the alarm has been silenced, parameter and high limit/low limit of triggered physiological alarm is still flickering. Please refer to 7.10 Technology Alarm Reset chapter for the presentation of technological alarm when it has been silenced.

If the monitor is switched to other alarm status or is triggered by a new physiological alarm or technological alarm when it is in the reset status, alarm reset status will be cancelled automatically.

7.9 Bolt-lock Alarm

Parameter alarm can be set as "Bolt-lock" or "Non Bolt-lock".

- **Bolt-lock:** Even if the reason for the parameter alarm has been eliminated, the system is still being "Locked", that is the corresponding alarm message to parameter alarm will be displayed continuously, but the alarm mode will change as followings:

Parameter and high limit or low limit of alarm will no longer flicker.

The previous time that the alarm was triggered will be displayed at the end of alarm message in parameter alarm area.

- Non Bolt-lock: While the reason for the parameter alarm has been eliminated, the system will not give any prompt message for the alarm of this parameter.

Parameter Alarm for Bolt-lock:

1. Select [Main Menu] - [Maintenance] - [User Maintenance] - Input User Maintenance Password.
2. Select [Alarm Setup 1 and enter [Alarm Setup] menu.
3. Set [Bolt-lock Alarm] as [High Level], [High & Middle Level], [All], or [Off].

Select [High Level] means the bolt-lock is only for high level alarm; Select [High & Middle Level] means the bolt-lock is only for high level and middle level of alarm; Select [All] means the bolt-lock is for all alarms, select [Off] means no bolt-lock.

NOTE

**The change of alarm level will impact on bolt-lock status of related alarm.
Please make judgement**

7.10 Detection of Alarm

The monitor will conduct automatic self-detection after starting. At this moment, the screen will display a startup picture, the indicators of physiological alarm and technical alarm light up from red to yellow in order, and the screen goes dark with the indicator of technological alarm while the system is making a sound of "Beep". This step means aural and visual alarm indicator has already worked in normal condition.

If further detection on the sole measurement parameter of alarm is needed, the monitor itself or simulator (such as SpO₂ or NIBP) is good for measurement and detection. Adjust the setup of alarm limit and check whether it can trigger a correct alarm respond.

7.11 Measures of Alarm

When alarm occurs in the monitor, please refer to the following steps to take corresponded measures:

1. Check patient's condition
2. Confirm the parameter in the occurring alarm or the type of alarm.
3. Identify the causes.
4. Eliminate the alarms.
5. Check whether the alarm is eliminated or not.

Please refer to the appendix E Alarm Information for the specific trouble shooting for all kinds of alarms.

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Chapter 8 ECG Monitoring

8.1 Introduction

Electrocardiogram (ECG) measures the cardiac electric activity and displays ECG waveforms and parameter values on the screen.

1. Algorithm package

It provides the functions of 3/5/12-lead monitoring, ST segment analysis, ARR analysis and 12-lead ECG diagnosis and analysis.

8.2 Safety Information



WARNING

- Only use ECG electrodes and cables provided by Our company.
- Do not use different metal materials for the electrodes.
- When placing the electrodes or connecting the cables, please do make sure that there is no contact with any conductive part or the earth, especially all the ECG electrodes are securely attached to the patient.
- Check the skin attached with ECG electrode regularly. If there is a sign of allergies, replace the electrodes or change the sites.
- When defibrillation is needed, non-defibrillating ECG cables should not be used.
- Do not touch the patient, table or instrument during defibrillation.

NOTE

- If correct electrode is used and the electrode is placed according to the manufacturer's instructions, the display screen can return to normal display within 10 seconds after defibrillation.
- Interference from a non-grounded instrument near the patient and ESU interference can cause inaccuracy of the waveform.

8.3 Monitoring Procedure

8.3.1 Basic Procedure

1. Skin preparation. Because the skin is a poor conductor, it is necessary to properly treat the skin where the patient placed the electrode in order to obtain a good ECG signal. Choose a flat place with few muscles to place the electrode, and treat the skin according to the following methods:

- Shave hair from the sites where electrode patches attach to.
- Rub the skin where electrode patches attach to gently to remove dead skin cells.
- Wash sites thoroughly with soap and water. (Never use ether or pure alcohol, because this increases skin impedance).

- Before installing the electrodes, let the sky dry completely.
- 2. Attach clip or snap to electrodes prior to placement.
- 3. Connect the electrode lead to the patient cable.
- 4. Connect the lead wire with the ECG main cable, adn then connect the main cable with the ECG interface

8.3.2 Choose Lead Type

1. Select ECG parameter area, and enter "ECG SETUP" menu—"OTHER SETUP > >"menu.
2. Set the "LEAD TYPE" to "3 LEADS", "5 LEADS", "12 LEADS" or "AUTO" according to the lead type you applied.

8.3.3 Installing Electrodes

The following description takes America standards as examples.

NOTE

- The following table gives the corresponding lead names used in Europe and America Standards. (Lead name is represented by R, L, N, F, C and C1-C6 respectively in Europe Standard, while corresponding lead name in America Standard is RA, LA, RL, LL, V and V1- V6.)

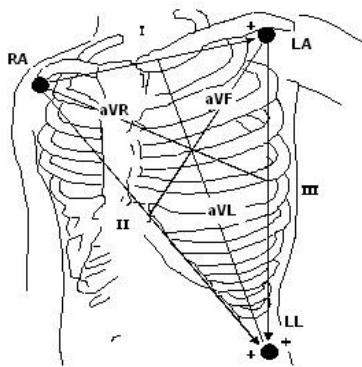
America Standard		Europe Standard	
Lead name	Color	Lead name	Color
RA	White	R	Red
LA	Black	L	Yellow
LL	Red	F	Green
RL	Green	N	Black
V	Brown	C	White
V1	Brown/Red	C1	White/Red
V2	Brown/Yellow	C2	White/Yellow
V3	Brown/Green	C3	White/Green
V4	Brown/Blue	C4	White/Brown
V5	Brown/Orange	C5	White/Black
V6	Brown/Purple	C6	White/Purple

The 3-lead

The placement of 3 lead electrodes is shown as below:

- RA (right arm): Under the clavicle, near the right shoulder

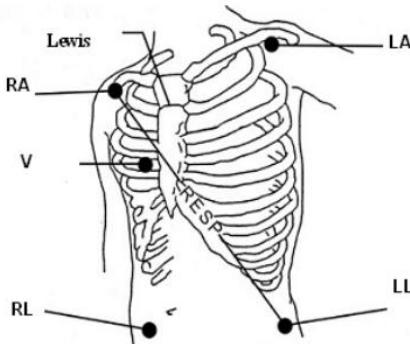
- LA (left arm): Under the clavicle, near the left shoulder.
- LL (left leg): Left lower abdomen



The 5-lead

The placement of 5-lead electrodes is shown as below:

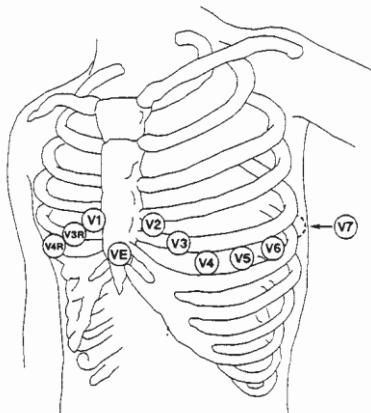
- RA (right arm) electrode: Under the clavicle, near the right shoulder.
- LA (right arm) electrode: Under the clavicle, near the left shoulder.
- RL (right leg) electrode: Right lower abdomen.
- LL (left leg) electrode: Left lower abdomen.
- V (chest) electrode: On the chest.



For 5-lead set, attach the chest electrode (V) to one of the indicated positions as below:

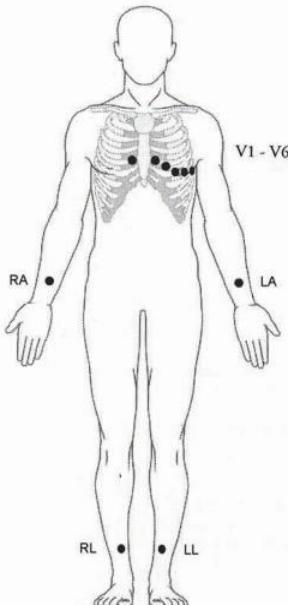
- V1: On the 4th intercostal space at the right sterna margin
- V2: On the 4th intercostal space at the left sterna margin.
- V3: Midway between V2 and V4 electrodes.

- V4: On the 5th intercostal space at the left clavicular line.
- V5: On the left anterior axillary line, horizontal with V4 electrode.
- V6: On the left middle axillary line, horizontal with V4 electrode.
- V3R-V7R: On the right side of the chest in positions corresponding to those on the left
- VE: Over the xiphoid position. For the placement of V-leads on the back, it should be attached on one of the following sites.
- V7: On the 5th intercostal space at the left posterior axillary line of back.
- V7R: On the 5th intercostal space at the right posterior axillary line of back.



The 12-lead

In American Standards, the 12-lead (10-lead cables) electrodes should be placed on limbs and chests. Limbs electrodes should be placed on the soft skin of both hands and feet, and the chest electrode should be placed according to the doctor's needs. As shown below:



Installing Electrodes for Surgical Patients

The installation of electrodes will depend on the type of surgery that is being performed. For example, with open chest surgery, the chest electrodes may be placed laterally on the chest or the back.

In addition, when using ES (Electrosurgery) equipment, in order to reduce the influence of pseudo error on ECG waveform, you can place electrodes on the right and left shoulders, the right and left sides near the stomach, and the chest lead on the left side of mid-chest. Avoid placing the electrodes on the upper arms, otherwise the ECG waveform will be too small.

WARNING

- When using electrosurgery equipment (ESU), ECG electrode should be placed in a position in equal distance from electrotome and the grounding plate to avoid cautery. Electrosurgery equipment wire and ECG cable must not be tangled up.
- When using electrosurgery equipment (ESU), never place an electrode near the grounding of the electrosurgery equipment, otherwise there will be a great interference with the ECG signal.

8.3.4 Check Pacing Status

Before starting ECG monitoring, it is very important to set the patient's pacing status correctly.

When "PACING" is "YES", the icon  is displayed in the ECG waveform area. When the system detects a pacing signal, it marks the symbol "|" at the baseline of the ECG waveform, and the color of the symbol is different from that of the waveform. When you set "PACING" to "NO" or do not set it, the icon  is displayed in the ECG waveform area.

You can change the pacing status in any of the following ways:

- Select the patient information area, or;
- Select "MAIN MENU"- "PATIENT MANAGEMENT"- "PATIENT INFORMATION", or;
- Select ECG parameter area- "OTHER SETUP >>";
- Then, set "PACING" to "YES" in the pop-up menu.

If you do not set the pacing status, the monitor will give a prompt tone when the pacing pulse is detected, the pacing icon will flash, and "Please confirm if the patient has a pacemaker" will be displayed in the ECG waveform area. At this point, please check and set the pacing status of the patient.

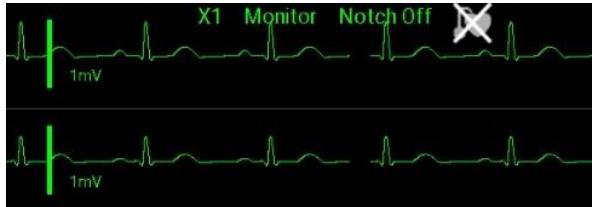


WARNING

- For pacing patients, "PACING" must be selected as "YES". Otherwise, the pacing pulse will be treated as a regular QRS complex, and when the ECG signal is too weak, system cannot detect and alarm. Do not rely entirely on the alarm information of heart rate calculation, patients with pacemakers should be placed under close monitoring.
- For non-pacemaker patients, "PACING" should be chosen as "NO".
- The automatic recognition function of pacemaker is not suitable for children and newborns.

8.4 ECG Display

The following figure is an interface of 5-lead monitoring, only for reference, and the figure displayed on your monitor may vary slightly.



In addition, when "PACING" is set to "YES" and the pacing signal is detected, the pacing pulse flag "|" is displayed in the ECG waveform.



See the description of 12-lead interface in the corresponding chapter.

8.5 Set ECG

8.5.1 Open ECG Menu

You can open the ECG menu in the following ways:

- Select the ECG parameter area and open the "ECG SETUP" menu.
- Select "MAIN MENU" - "MEASUREMENT SETUP" - "ECG SETUP" to open the "ECG SETUP" menu.

8.5.2 Set Alarm Source

In most cases, the values of heart rate and pulse rate are the same. In order to avoid triggering the heart rate and pulse rate alarm at the same time, the monitor can choose one of them as the alarm source. To change alarm source, first go to the "ECG SETUP" or "SpO₂ SETUP" menu, select "ALARM SOURCE", and then select:

- "ECG": The monitor uses heart rate as the alarm source of heart rate / pulse.
- "SpO₂": The monitor uses the pulse rate as the alarm source of heart rate / pulse.
- "AUTO": As long as the ECG measurement is turned on, the effective heart rate can be obtained, and the monitor will use the heart rate from the ECG measurement as the data source.

If the heart rate is not available, such as when the lead is disconnected, and a pulse source is turned on and available, the monitor automatically takes the pulse rate from the current measurement as the data source and displays it in the ECG parameter display area. After that, if the heart rate can be obtained again, the monitor will automatically restore the heart rate to the

data source. If an alarm occurred for the pulse rate or heart rate, both of them will be alarmed.

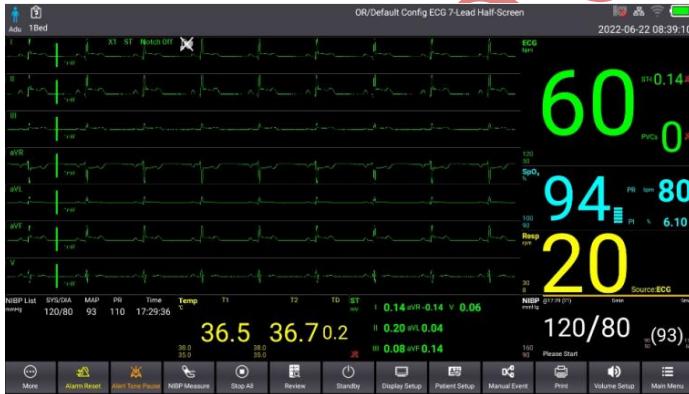
8.5.3 Select Lead Type

In "OTHER SETUP" of "ECG SETUP", you can set "LEAD TYPE". If the system supports automatic lead type recognition, you can set "LEAD TYPE" to "AUTO".

8.5.4 Set Monitoring Interface

When using 5-lead or 12-lead monitoring, select the "INTERFACE SELECTION" hot key, and in the "INTERFACE SELECTION" window, you can select the interface type as follows:

- "ROUTINE MONITORING INTERFACE": Two ECG waveforms are displayed in the waveform area.
- "FULL SCREEN 7-LEAD INTERFACE": The waveform area displays 7 ECG waveforms, while the waveforms of other parameters are not displayed.



- "HALF SCREEN 7-LEAD INTERFACE": The upper part of the waveform area displays 7 ECG waveform.



When using 12-lead monitoring, you can also select "FULL SCREEN 12-LEAD INTERFACE". In the "ROUTINE MONITORING INTERFACE", you can also set the "CASCADE" in the ECG menu to "ON", at this time, the first ECG waveform is displayed by channel-2 waveform location.

8.5.5 Set Filtering Mode

The setup of ECG filtering mode determines how to smooth the ECG waveform. In the ECG menu, you can set "FILTER" to:

- "MONITORING": Used under normal measurement.
- "DIAGNOSIS": Used when diagnostic quality is required. At this point, the unfiltered ECG waveform is displayed, and you can see the changes in the waveform, such as the notch of R wave, the discrete elevation or depression of ST segment, and so on.
- "SURGERY": Used when the signal is disturbed by high frequency or low frequency. High-frequency interference usually causes high-amplitude spike, causing the ECG signal to look irregular. Low-frequency interference usually leads to baseline drift or thickening. In the operating room, selecting "OPERATION" mode can reduce artifacts and interference from electrosurgical equipment. In normal measurement, selecting this method may suppress the QRS complex and interfere with the ECG analysis.

NOTE

- It is recommended that patients should be monitored by "DIAGNOSIS" as far as possible when the interference is small.

8.5.6 Set Power Frequency Notch

1. Select ECG parameter area.

2. Select "OTHER SETUP>>".
3. Set "POWER FREQUENCY NOTCH" to:
 - "OFF": No filtering.
 - "ON": Used when the waveform is jitter.

8.5.7 Set Pace-making Inhibition

Select "PACE-MAKING INHIBITION" to "ON" or "OFF" through "ECG SETUP"- "OTHER SETUP>>"- "PACE-MAKING INHIBITION".

When "PACE-MAKING" is set to "YES":

- Turning on "PACE-MAKING INHIBITION" will inhibit the display of pace-making signals, but when pace-making signals are detected, the pace-making pulse sign "||" is still displayed above the ECG waveform.
- Turning off "PACE-MAKING INHIBITION" will not inhibit the display of pace-making pulses. When a pace-making signal is detected, the pace-making pulse sign "||" will be displayed above the ECG waveform.

When "PACE-MAKING" is "NO", the setting of "PACE-MAKING INHIBITION" does not affect the display of pace-making signal.

8.5.8 Set ECG Waveform

Select an ECG parameter area to open the "ECG SETUP" menu to set the waveform. Select "ECG1" or "ECG2" (select different lead types and ECG interfaces, different options will appear in the menu), and then select the appropriate lead. The selected lead waveform should have the following characteristics:

- QRS should be completely above or below the baseline and should not be biphasic.
- QRS should be high and narrow.
- P wave and T wave should be less than 0.2mV.
 - If the ECG waveform is too small or clipped, you can select "ECG GAIN" from the setup menu to change the amplitude of the ECG waveform. Under the "ROUTINE MONITORING INTERFACE", "ECG GAIN" only changes the amplitude of the selected ECG waveform. In other display interfaces, the amplitudes of all ECG waveforms are changed at the same time.
 - Select "WAVEFORM SPEED": Select appropriate setup in the pop-up list. The higher the value, the faster the scanning speed and the wider the waveform.

8.5.9 Set Smart Lead Off

If the "SMART LEAD OFF" function has been set to "ON", and the lead of the ECG waveform with filtering mode and notch state falls off, if there are other leads available, the system will automatically switch the waveform to the waveform of available leads, and recalculate the heart rate, analyze and detect arrhythmia. When dropped lead is reconnected, the lead will automatically switch back to the original state.

Select "OTHER SETUP >>" in the "ECG SETUP" menu, and set "SMART LEAD OFF" to "ON" or "OFF" respectively in the pop-up menu to turn on or turn off the smart lead off function.

8.5.10 Set Alarm Level Triggered by Lead Off

Click "ALARM SETUP >>" in the "USER MAINTENANCE" menu, and then you can set the "ECG OFF LEVEL" in the pop-up menu.

8.5.11 QRS Sound

The monitor will emit QRS sound according to the alarm source. You can select "OTHER SETUP >>" from the "ECG SETUP" menu, and adjust the "HEARTBEAT VOLUME" in the pop-up menu to adjust the QRS volume.

8.6 ST Segment Analysis

- ST segment analysis function is not applicable to newborns and is "OFF" by default
 - ST segment analysis can measure the elevation or depression of the ST segment on the specified lead.
 - ST segment measurement value is measured in: mV (millivolts) or mm (millimeters). You can select it from the "UNIT SETUP" on the "USER MAINTENANCE"
 - The meaning of ST segment measurement value: Positive number indicates elevation, negative number indicates depression.
-
- ST segment measurement range: -2.0 ~+2.0 mV



WARNING

-
- The data accuracy of the classic ST algorithm has been tested, and its clinical significance should be determined by doctors.
-

8.6.1 ST ON/OFF

To turn on or turn off the display of the ST parameter area, see the section of setting the parameter display switch.

Some clinical situations can make it difficult to obtain reliable ST monitoring, such as:

- Low noise leads cannot be obtained;
- There are arrhythmias leading to irregular baselines, such as atrial fibrillation/flutter;
- The patient is undergoing continuous ventricular pacing;
- The patient has left bundle branch block.

When these conditions exist, you should consider turning off ST monitoring.

8.6.2 Filter Mode

When ST segment analysis is turned on, the filter mode will be automatically converted to "ST". When ST segment analysis is turned off, the filtering mode automatically returns to the previous manual setup.

ST segment analysis function can only be performed when the filter mode is "DIAGNOSTIC". When ST segment analysis is turned on, if the filter mode is not "DIAGNOSTIC", it will be automatically converted to "DIAGNOSTIC" or "ST". When ST segment analysis is turned off, the filtering mode automatically returns to the previous manual setup.

8.6.3 ST Display

8.6.3.1 ST Parameter Area

The following figure shows the ST display at 5-lead, for reference only, the graphics displayed on your monitor may be slightly different.

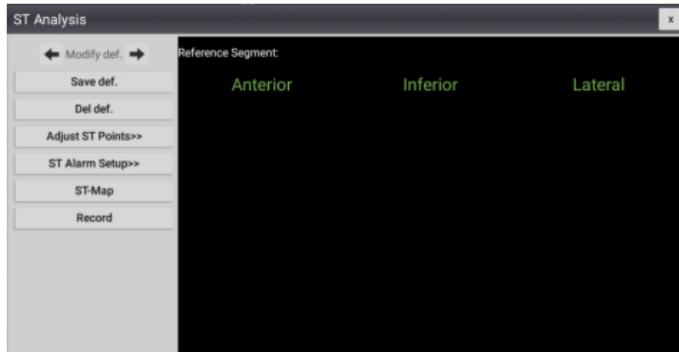
ST	I	0.49	aVR	---	V	---
mV	II	0.67	aVL	---		
✖	III	0.04	aVF	---		

8.6.3.2 ST Segment

ST segment displays a complete QRS waveform segment of each ST lead. Current segment and current ST value are drawn in the same color as the ECG wave, usually green. Stored reference segment and their ST values are drawn in white. The information of ST segment is updated every 10 seconds.

In routine interface, to display ST clips:

1. Set a non-waveform parameter display area to "ST"
Select ECG parameter area, and select "ST SEGMENT ANALYSIS > >" to enter the "ST SEGMENT ANALYSIS" menu.



8.6.4 Save Current ST Segment as Reference Segment

Select "SAVE REFERENCE" from the "ST SEGMENT ANALYSIS" menu to save the current set of ST segment as reference segment. You can save up to 20 sets of reference segment.

NOTE

- If 20 sets of reference segments have been saved, the system will automatically delete the first set of ST segment when saving a new set of ST segment.

8.6.5 Change Reference Segment

Select and buttons on both sides of "CHANGE REFERENCE" in the "ST SEGMENT ANALYSIS" menu to switch between different groups of ST reference segment.

8.6.5 Delete Reference Segment

The currently displayed reference segment can be deleted by selecting "DELETE REFERENCE" from the "ST SEGMENT ANALYSIS" menu and "OK" in the pop-up dialog box.

8.6.6 Record ST Segment

To record the current ST segment and reference segment, please select "RECORD" from the "ST SEGMENT ANALYSIS" menu.

8.6.7 Set ST Alarm Limit

Select "ST ALARM SETUP >>" in the "ST SEGMENT ANALYSIS" menu to set the high limit and low limit of alarm triggered by ST measured value of each lead.

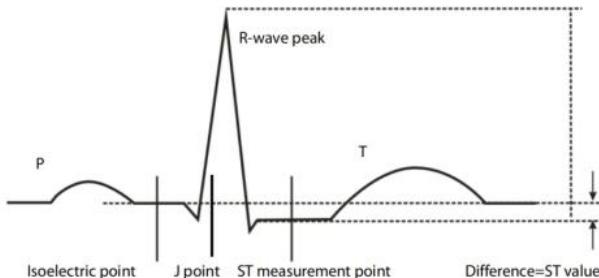
8.6.8 Set ST Alarm Delay Time

In the "OTHER" window of the "ALARM SETUP" menu, you can set ST alarm delay time.

8.6.9 Determine ST Segment Analysis Point

As shown in the figure, if the reference point of the ST measurement point is set as the R wave crest point, the ST measurement value of each heartbeat complex is the difference of the vertical distance between the crest point and the two measurement points.

ST analysis point



When you start monitoring or when the patient's heart rate or ECG waveform changes significantly, you need to adjust the location of the ISO and ST points. The abnormal QRS complex is not considered in the ST segment analysis.



WARNING

- Always make sure that the location of the ST measurement point is suitable for the patient being monitored.

To adjust ST segment analysis point:

1. Select "ST POINT SETUP >>" from the "ST SEGMENT ANALYSIS" menu. The three vertical lines in the "ST POINT SETUP" window represent the locations of ISO, J, and ST points, respectively.
2. Select ← and → buttons on both sides of "LEAD BROWSING", and select an ECG lead with obvious J point and P wave.
3. Select the "ISO" and "J POINT" options, and then click on the left and right sides of the interface to adjust the position of each point. "ST POINT" is set by option.
 - The ISO point cursor determines the position of the equipotential point relative to the R wave peak. Position the ISO point in the middle of

the flattest part of the baseline (between P wave and Q wave or in front of P wave).

- The J point cursor determines the position of the J-point relative to the R wave crest. It helps to locate ST points correctly. The J point is located at the end of QRS wave group and at the beginning of ST segment.

ST point is located at a fixed distance from the J point ST, J+60/80, J+40, J+60 or J+80. Move J point cursor to position ST point in the middle of ST segment. The system automatically adjusts the location of ST point according to the heart rate of the current patient: When the heart rate of patient is greater than 120, the system will select J+60 to determine the location of ST point; When the patient's heart rate is less than or equal to 120, the system will select J+80 to determine the location of ST point.

8.7 Arrhythmia Analysis

Arrhythmia analysis evaluate patient's condition, including heart rate, PVC frequency, rhythm, and abnormal heartbeat.

WARNING

- The function of arrhythmia is suitable for the detection of ventricular arrhythmias, but not for atrial or supraventricular arrhythmias. Sometimes, it may detect wrong arrhythmia. Therefore, physicians must combine more clinical manifestations to analyze arrhythmia information.
- The arrhythmia analysis function is not suitable for newborns.

8.7.1 Arrhythmic Events

Algorithm

Arrhythmia	Description	Classification
ASYSTOLE	No QRS and no ventricular fibrillation or disorder signal within the set asystole threshold.	
VFIB/VTAC	Fibrillation wave for consecutive 6 seconds, or the dominant rhythm of many adjacent ventricular beats, and the heart rate is greater than the alarm limit of ventricular rhythm.	Lethal Arrhythmias
SVT (Supraventricular tachycardia)	Continuous PVC (V) is greater than or equal to the PVC limit of ventricular tachycardia, and the heart rate is greater than or equal to the heart rate limit.	

Vent, Brady	The number of continuous PVC is greater than or equal to the continuous threshold of ventricular bradycardia, and the ventricular heart rate is less than the ventricular bradycardia heart late threshold.	Nonlethal Arrhythmias
Extreme Tachy	Heart rate is greater than or equal to extreme tachycardia limit.	
Extreme Brady	Heart rate is less than or equal to extreme tachycardia limit.	
PVCs	PVCs/min exceeds set high limit.	
PNP	No pacing pulse within 1.75 times of the average RR interval after one QRS wave (only for pacing patients).	
PNC	No QRS wave was detected within 300 ms after one pacing pulse (only for pacing patients).	
PVC	Single PVC occur in normal heartbeats.	
COUPLET	Paired PVC occur in normal heartbeats.	
VT>2	There are more than two continuous PVC.	
BIGEMINY	The dominant rhythm of N, V, N, V, N and V.	
TRIGEMINY	The dominant rhythm of N, N, V, N, N, V, N, N and V	
R on T	R on T are detected in normal heartbeat.	
MISSED BEATS	When HR<120, no heartbeat was detected within 175x average R-R interval, or no heartbeat was detected within 1 second when HR>120, or no heartbeat was detected when the time exceeded the set cardiac apnea threshold.	
BRADY	The average heart rate is less than or equal to bradycardia limit.	
Nonsus, Vtrac	Continuous PVC (V) is greater than or equal to ventricular bradycardia PVC limit, and heart rate is greater than or equal to ventricular bradycardia heart rate limit but lower than ventricular tachycardia heart rate limit.	
Multif, PVC	Different forms of premature ventricular contraction (PVC) were detected in the pleomorphic PVC window (configurable).	

BRHYTHM	Continuous PVC (V) is lower than ventricular tachycardia PVC limit but more than 2, and the heart rate is greater than or equal to the ventricular tachycardia heart rate limit.	
PAUSE	No QRS within set cardiac apnea threshold.	
Irr. Rhytm	Persistent irregular rhythm.	
Marked Irr. Rhythm	Marked and persistent irregular rhythm.	

Set arrhythmia alarm

Select the ECG parameter area- "ECG SETUP"- "ARRHYTHMIA ANALYSIS >>", and the alarm for each arrhythmia can be set in the pop-up menu. You can set "ALARM LEVEL" to "HIGH", "MEDIUM", "LOW" or "PROMPT", or you can set all arrhythmia analysis alarm "ON" or "OFF". In the "ALARM SETUP" menu of "USER MAINTENANCE", you can also set whether to turn off the switch of fatal arrhythmia analysis alarm.



WARNING

- If you turn off all arrhythmia analysis alarms, the system cannot give an arrhythmia alarm. Users should pay close attention to the actual clinical condition of patients.

8.7.2 Arrhythmia Threshold Setup

Select ECG parameter area or wave area- "ARRHYTHMIA ANALYSIS >>"- "ARRHYTHMIA THRESHOLD". You can set thresholds for some arrhythmias. When the value of an arrhythmia exceeds the threshold, an alarm will be triggered. The setup of asystole time is associated with ECG self-learning. When the HR is less than 30 bpm, it is recommended to set the asystole time to 10 seconds.

Algorithm Arrhythmia threshold setup

Parameter	Set Range	Default Value	Step Size	Unit
PVCs High Limit	1~100	10	10	PCS/min
ASYSTOLE TIME	2~10	5	5	s
VTACHR	100~200	Adults: 120 Children:160	130	bpm
VTACPVC	3~12	Adults: 50 Children: 75	6	heart beat

Multif, PVC Bandwidth	3~31	Adults: 160 Children:180	15	heart beat
TACHY High Limit	Adults: 10~300 Children: 160~300	Adults: 100 Children:160	5	bpm
BRADY Low Limit	Adults: 15~60 Children: 15~80	Adults: 60 Children: 80	5	bpm

Extended arrhythmia threshold setup

Parameter	Set Range	Default Value	Step Size	Unit
PVCs High Limit	1~100	10	1	PCS/min
ASYSTOLE TIME	3~10	5	1	s
TACHY High Limit	60~300	Adults:120 Children:160	5	bpm
BRADY Low Limit	15~120	Adults: 50 Children: 75	5	bpm
Extreme Tachy	120~300	Adults: 160 Children:180	5	bpm
Extreme Brady	15~60	Adults: 35 Children: 50	5	bpm
Multif. PVC Bandwidth	3~31	15	1	PCS/min
VTACHR	100~200	130	5	bpm
VTACPVCs	3~99	6	1	PCS/min
PAUSETIME	1.5,2.0,2.5	2	/	s
Vent. Brady PVCs	3~99	5	1	PCS/min
Vent. Brady HR	15~60	40	5	bpm

8.7.3 Set Extended Arrhythmia

Extended arrhythmia refers to the following ten arrhythmic events in algorithm:

- Extreme Tachy
- Extreme Brady
- Nonsus. Vtrac
- Vent. Brady
- BRHYTHM

- Multif. PVC
- PVCs/min High
- PAUSE
- Irr. Rhythm
- Marked Irr. Rhythm

You can select "MAIN MENU"- "MAINTENANCE"- "USER MAINTENANCE"- enter user maintenance password- select "ALARM SETUP >>", and then set "EXTENDED ARRHYTHMIA" to "ALLOW" or "DISABLE". When "EXTENDED ARRHYTHMIA" is set to "DISABLE", the system will not analyze and alarm the extended arrhythmia.

CAUTION

- When the monitor is connected to the central monitoring system prior to version 3.0.6, please set "EXTENDED ARRHYTHMIA" to "DISABLE", otherwise, when the extended arrhythmia is present, the central monitoring system may not be able to display these alarms properly.
-

8.7.4 Review of Arryhtmia

See the *review* chapter.

8.8 ECG Self-Learning

8.8.1 Start ECG Self-Learning Manually

During ECG monitoring, when the patient's ECG template changes greatly, you may need to initiate an ECG self-learning. Changes to the ECG template may result in:

- False arrhythmia alarm
- ST measurement missing
- Inaccurate heart rate

ECG self-learning enables the monitor to learn new ECG templates to correct arrhythmia alarms and rhythm values, and to restore ST measurements. To start a self-learning manually: Select the "SELF-LEARNING" in ECG parameter area.

CAUTION

- Please start ECG self-learning manually during the normal rhythm and when the ECG signal is relatively noise-free. Because if ECG self-learning is performed during arrhythmia, it is possible to learn the wrong QRS complex as an ECG template, resulting in missed detection of arrhythmic events.
-

8.8.2 Automatically Start ECG Self-Learning

ECG self-learning starts automatically in the following situations:

- Change lead type
- Reconnect the lead
- Re-receive patient
- After completing the calibration, select "STOP ECG MODULE CALIBRATION"
- During 5/12-Lead monitoring, switching interface between several options in the interface type.
- Change patient pacing setup

8.9 12-Lead Monitoring

8.9.1 Enter 12- Lead Monitoring Interface

1. Select and install 12-lead monitoring electrodes as described above.
2. Set "LEAD TYPE" to "12-LEAD" and interface type to "FULL SCREEN 12-LEAD INTERFACE". Under the 12-lead interface, 12 ECG waveforms are displayed in waveform area. Rhythm lead is ECG before entering the interface, which is the first waveform in the upper left position of the 12 channel waveform area. ST values are shown in three columns:
 - Ant(Anterior): VI, V2, V3, V4
 - Inf (Inferior) : II, I, aVf,(aVR)
 - Lat (Lateral) : I, aVL, VS, V6

Although aVR is displayed in the Inf. column, it is not part of the inferior lead. In addition, 12-guide interface has the following features:

- When entering 12-lead interface, the "FILTER MODE" is automatically switched to "DIAGNOSIS"; when exiting 12-guide interface, the "FILTER MODE" is restored to the setup before entering 12-lead interface.

NOTE

-
- If you are unable to enter 12-lead diagnosis, please check whether all lead wires are connected to the patient and whether the device supports 12-lead working mode.
-

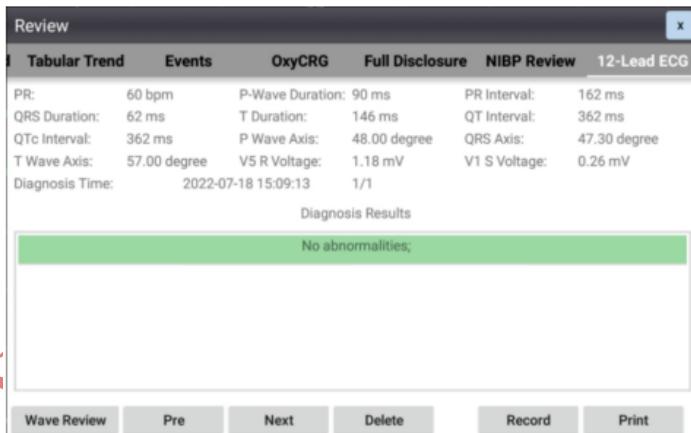
8.9.2 12- Lead Resting Analysis

⚠️ WARNING

-
- 12-Lead ECG resting analysis is only applicable to adults.
-

After entering 12-lead monitoring interface, you must wait 11 seconds before the analysis can be carried out, otherwise it will indicate that the data is insufficient and the analysis cannot be carried out. To perform a 12-lead rest analysis, first select the "CAPTURE" hot key, after a 10-second countdown, you can select the "ANALYZE" hot key, and the system will pop up the menu shown in the following figure. In this menu, you can:

- Select "RECORD RESULT" to output the results of 12-lead resting analysis through the recorder.
- Select "RECORD WAVEFORM" to output the results of 12-lead resting analysis and capture 12-lead waveforms through the recorder.
- Select "PRINT REPORT" to output a 12-lead resting analysis report through the printer. In addition, after selecting the "CAPTURE" hot key, you can:
- Select the "BROWSE" hot key and review the frozen ECG waveform by clicking or swiping the interface.
- Select the "RECORD" hot key to output captured 12-lead waveform.



8.9.3 Review 12- Lead Resting Analysis

In the 12-lead interface, select the "Review" hot key to review the existing 12-lead resting analysis results. In this window, you can view the waveform by doing the following operations:

- Slide the screen left and right to scroll the waveform for viewing;
- Slide the screen up and down to switch ECG waveform;

- Slide the screen up and down by double fingers to adjust the gain of waveform;
- Slide the screen left and right by double fingers to adjust the speed of waveform;

8.10 Display area of QT parameters

There are four parameters (QT, QT-HR, QTC, ΔQTc) included. Parameter area is shown as below:



8.10.1 Turn on/off QT

Before turning on or off the QT parameter area, the QT switch status need to be confirmed in the ECG setup menu, and refer to the chapter on setting the parameter display switch.

8.10.2 QT Setup

- Lead-setup of QTc calculation: it can be set to "Auto" or corresponding lead
- Formula setup of QTc calculation: options include "Hodges" "Bazett" "Fridericia" "Framingham"

8.10.3 QT Analysis

The baseline waveform is displayed in white in the lower part.

The waveform of selected lead is highlighted and displayed in green, and waveforms of other leads are displayed in light green or gray.

The starting point of the QRS complex and the ending point of the T-wave are marked with vertical lines.

Slide the screen up and down to switch the lead waveform display

The reference interface is shown in the figure below:



Chapter 9 Resp

9.1 Introduction

Breath was measured by chest impedance method. When the patient breathes, the thoracic activity causes a change in the thoracic impedance between the two ECG electrodes. The monitor produces a respiratory wave on the screen by measuring the impedance change. The monitor calculates the respiration rate (RR) based on the waveform cycle.

9.2 Safety Information



WARNING

- When monitoring the patient's breathing, it is not allowed to use the ECG cable of anti-electric knife type.
- If the breath detection level is not set correctly in manual calculation mode, the monitor may not detect the apnea state. If the deflection level is set too low, the monitor is more likely to detect cardiac activity and misinterpret cardiac activity as respiratory activity when apnea occurs.
- Respiratory measurement does not recognize the reason of suffocation, it will only give alarm if no next respiration is checked within the predetermined time after the last breath, so it can not be used for diagnostic purposes.
- If operating under conditions complying with EN 60601-1-2 (radiation resistance: 3V/ M), a field intensity greater than 1V/m may result in wrong measurements at all frequency ranges. Therefore, it is recommended not to use electrical radiation equipment near respiratory detection equipment.

9.3 Resp Display



Select the parameter area to open the "Resp Setup" menu.

NOTE

- Respiratory monitoring is not recommended to be used on patients who are very active, as this can cause false alarms.

9.4 Placement for Resp Electrode

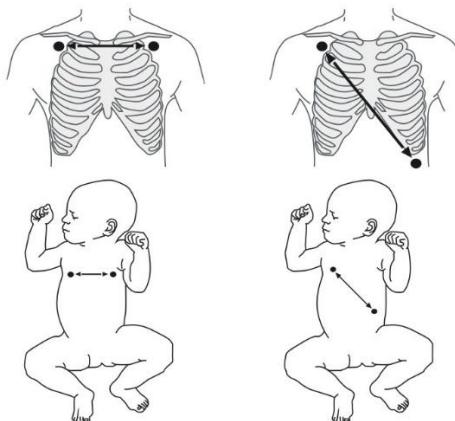
As the skin is a bad conductor, in order to get a good respiration signal, process the skin where the electrode is placed is necessary. See "ECG Monitoring" chapter for skin processing method.

Respiration measurement uses standard ECG cable and electrode placement methods. You can use different ECG cables (3-lead, 5-lead, or 12-lead). Respiratory signals are measured between two ECG electrodes. If standard ECG electrode positions are used, these two electrodes are RA (right

arm) and LA (left arm) electrodes in 1 lead, or RA (right arm) and LL (left leg) electrodes in 11 lead.

NOTE

- In order to obtain the best respiratory wave, RA and LA electrodes should be placed horizontally when I lead is selected to measure respiration; RA and LL electrodes should be placed diagonally when II lead is selected to measure respiration.



9.4.1 Adjust the position of respiratory electrode

If you want to measure respiration while measuring ECG, you may need to adjust the positions of the two electrodes that measure respiration. Adjusting the standard position of ECG electrode will lead to changes in ECG waveform and may affect ST and arrhythmia analysis.

9.4.2 Cardiac activity superposition

The effect of cardiac activity on respiratory waveform is called cardiac activity superposition. This happens when the respiratory electrode collects impedance changes caused by rhythmic blood flow. Proper placement of respiratory electrodes can reduce this effect. The liver region and ventricle should be avoided from being connected to the respiratory electrode, so as to avoid artifacts generated by the heart or pulsating blood flow, which is especially important for neonates.

9.4.3 Abdominal breathing

Some patients have limited chest movement and they breathe mainly through the abdomen. At this time, you may need to place the left leg

electrode at the position where the left abdomen is most expanded to obtain the best respiratory waveform.

9.4.4 Thoracic expansion

Some patients (especially neonates), due to their clinical condition, expand their chest laterally, causing a negative intrathoracic pressure. In these cases, it is better to place two RESP electrodes in the right axillary and the left lateral chest areas at the maximum point of breathing movement to optimize the respiratory waveform.

9.5 Select Respiratory Lead

In the "Resp Setup" menu, you can select "Resp Lead" as "I" and "II".

9.6 Set suffocation delay

In the "Resp Setup" menu, you can set "Suffocation Delay": the time when the patient's suffocation occurs. When the time exceeds the set time, the monitor will trigger an alarm. The "Suffocation Delay" settings in Resp and CO₂ modules keep linkage.

9.7 Change calculation mode

In the menu of "Resp Setup", you can set the "Calculation Mode" to "Auto" or "Manual".

1. "Auto"

The monitor automatically adjusts the detection level according to the waveform height and whether there is cardiac artifact. In this mode, the detecting horizontal dotted line will not be displayed on the respiratory waveform.

"Auto" mode should be selected in the following cases:

- The respiratory rate is not close to the heart rate.
- Breathing is active with or without continuous positive airway pressure (CPAP).
- Patients were mechanically ventilated, except for patients with intermittent mandatory ventilation (IMV).

2. "Manual"

In "Manual" mode, the respiratory detection level must be set. You can select "upper dotted line" and "lower dotted line" to manually adjust the position of detecting horizontal dotted line on respiratory waveform. Once set, the detection level will not automatically adapt to different breathing depths. Therefore, if the depth of breathing changes, you may need to change the detection level.

"Manual" mode should be selected in the following cases:

- The respiratory rate is close to the heart rate.
- Patients are given intermittent mandatory ventilation.
- Breathing is weak. Try to reset the electrodes to improve the signal quality

In automatic detection mode, if you are monitoring respiration and the ECG is turned off, the monitor cannot compare the ECG with the respiration rate to detect the cardiac activity superposition. At this time, the respiratory detection level is automatically set to high to prevent the superposition of cardiac activity from being detected as respiratory.

In manual detection mode, some cardiac activity superposition may trigger the respiration calculator, resulting in incorrect high respiration rate indication or apnea state that cannot be detected. If you suspect that cardiac activity superposition is regarded as respiratory activity, raise the level of respiratory detection to be higher than that of cardiac activity superposition. If the detection level cannot be improved due to the small respiratory waveform, you may need to optimize the electrode position according to the description in the chapter "Thoracic Expansion".

9.8 Change waveform



WARNING

- In Manual" mode, after changing the gain of the respiratory waveform, be sure to check the horizontal dotted line.

Open the "Resp Setup" menu.

1. Select "Gain": the greater the gain, the higher the waveform amplitude.
2. Select "Waveform Speed": Select the appropriate setting in the pop-up list. The larger the value, the faster the scanning speed and the wider the waveform.

9.9 Set RR Source

To set the RR source:

1. Open the "Resp Setup" menu.
Select "RR Source" and then select a source or "Auto" in the pop-up list.

The list shows the currently valid RR sources. When you select "Auto", the RR source is automatically selected by priority. When there is no valid measurement for the current set RR source, the system will automatically switch "RR source" to "Auto".

The priority order of RR sources is as follows (from high to low): CO₂ measurement, ECG.

The "RR source" settings in Resp and CO₂ modules keep linkage.

The RR source settings and their descriptions are shown in the table below.

Set Item	Function Description
Automatic	Automatically select RR source from high to low according to priority
CO ₂	From CO ₂ measurement
ECG	From impedance respiratory measurement

9.10 Set alarm properties

In the "Resp Setup" menu, select "Alarm Setup >>". In the pop-up "Alarm Setup" menu, you can set the alarm properties of this parameter.

Chapter 10 PR

10.1 Introduction

The mechanical activity of the heart causes the pulsation of the artery, and the PR (Pulse) value can be obtained by measuring the pulsation. PR values can be obtained by measuring SpO₂ or any kind of arterial pressure (see Chapter "IBP"). The color of PR parameter area is consistent with that of SpO₂ parameter or arterial pressure.

10.2 PR Source

The currently valid pulse source is displayed in the SpO₂ parameter area. Pulse rate of this pulse source:

- It is detected as the pulse of the system and generates an alarm when you select the pulse rate as the alarm source.
- It is stored in the monitor's database and can be reviewed in the trend chart/table. In the trend chart, the color of PR curve is consistent with the parameter color of current PR source, and the source of PR in historical data cannot be distinguished.
- It is sent to the central monitoring system (if any) through the network. To set PR source:
 1. Open the "SpO₂ Setup" menu.
 2. Select "PR Source" and then select a label name or "Automatic" in the pop-up list. The list shows currently valid PR sources from top to bottom by priority. When you select "Automatic", the system automatically selects the first option in the list as the PR source. When the current PR source does not exist, the system will automatically switch "PR Source" to "Automatic".

10.3 Set Alarm Source

In most cases, the values of heart rate and pulse rate are the same. In order to avoid triggering heart rate and pulse rate alarms at the same time, the monitor can select one as the alarm source.

To change the alarm source, first enter the "ECG Setup" or "SpO₂ Setup" menu, select "Alarm Source", and then select:

- "ECG": The monitor uses heart rate as the alarm source of heart rate/pulse.
- "SpO_{2- "Auto": As long as the ECG measurement is turned on and the valid heart rate can be obtained, the monitor will use the heart rate from the ECG measurement as the data source.}

If the heart rate is not available, such as when the lead is disconnected, and a pulse source is turned on and available, the monitor automatically takes the pulse rate from the current measurement as the data source and displays it in the ECG parameter display area. After that, if the heart rate can be obtained again, the monitor will automatically restore the heart rate to the data source. If an alarm occurred for the pulse rate or heart rate, both of them will be alarmed.

10.4 QRS sound

When the alarm source is pulse rate, the monitor will emit QRS sound according to PR source. You can adjust the QRS volume by adjusting the “Pulse Volume” in the “SpO₂ Setup” menu.

Chapter 11 SPO₂ Monitoring

11.1 Introduction

SPO₂ was measured by a continuous, non-invasive, pulse oximeter method. It measures the luminous flux of light with a specific wavelength emitted from the light source of the sensor, which reaches the photodetector end of the sensor after being absorbed by oxyhemoglobin in the patient's tissue, to obtain blood oxygen saturation and pulse rate. This monitor has been calibrated to display functional oxygen saturation.



1. Pleth waveform: The amplitude of Pleth waveform can directly reflect the strength of the patient's pulse signal. The Pleth waveform is not normalized, which is used as the indicator for signal incompleteness. So the accuracy of the measured values may decrease if the waveform does not smooth or stable. When the waveform tends to be smooth and stable, the measured value is the optimal value, and the waveform is the most standard.
2. Arterial oxygen saturation (SpO₂): The percentage of oxygenated hemoglobin in total hemoglobin.
3. Perfusion index (PI): Perfusion index (PI) is the percentage of pulsations and non-pulsations in the blood oxygen signal caused by changes in arterial blood flow. Perfusion index reflects the signal intensity of blood oxygen signal and partly indicates the signal quality. The perfusion index above 1 is the best; 0.3-1 is acceptable; under 0.3 is weak perfusion state, so it is necessary to adjust the probe or select the better perfusion site. During continuous weak perfusion, if possible, verify the saturation status by other methods,
4. Perfusion bar chart: proportional to pulse intensity.
5. Pulse rate (PR): the number of pulses per minute detected (obtained from plethysmographic waveform).
6. The main parameters of the optical sensor are as follows: Red light: The wavelength is approximately 660 nm, and the optical output power is less than 6.65 mW Infrared light: The wavelength is about 905 nm, and the optical output power is less than 6.75 mW
7. Data averaging and signal processing have a delay in the upgrade of SpO₂ data values. When the data update period is less than 30 seconds, the time for obtaining dynamic average values will increase, which is arisen from signal degradation, low perfusion or other interference, it depends on the PR value.

8. Requirements of the subject: The subject should be 18 to 45 years old, with clean fingers, no nail polish or similar cosmetics on the fingers, and the nails are not too long. During the test, the subject's finger should be fully inserted into the device (as deep as possible). The subject lies flat on a comfortable bed or sits on a bed or chair, in a relaxed state. During the test, the subject's finger should be kept as still as possible (put a flat cushion under the hand could be better).

NOTE

- Excessive ambient light may affect the measured results, such as surgical light (especially xenon light sources), bilirubin lamp, fluorescent lamp, infrared heater and direct sunlight, etc. In order to prevent interference from ambient light, make sure to place the sensor properly and cover the sensor with opaque material.
- As to the fingers which are too cold or too thin or whose fingernail is too long, it may affect the measured results, so please insert the thicker finger such as thumb or middle finger deeply enough into the probe when measuring.
- When inserting the finger, the light emitted from the sensor must be directly irradiated to the side of the fingernail.
- During measuring, do not shake the finger and keep quiet, not move.
- The pulse oximetry monitor has a specific calibration curve, which is accurate for the combination of the pulse oximetry monitor and the probe, therefore, the functional tester can measure the error part of the monitor that came from the overall error of the monitor/probe system, and this functional tester can also measure the accuracy of the pulse oximetry monitor that replicates this calibration curve.
- The claims of SpO₂ accuracy shall be supported by clinical study measurements taken over the full range. By artificially inducing to different stable oxygen levels, and collect the SpO₂ value in range of 100%~70% at the same time, forming paired data for accuracy analysis.
- There are 36 healthy volunteers (male:22, female:14; age: 4-82; skin color: dark black: 2, medium black: 4, light: 25, white: 5) data in the clinical report.
- Because pulse oximeter equipment measurements are statistically distributed, only about two-thirds of pulse oximeter equipment measurements can be expected to fall within the accuracy (Arms) of the value measured by a CO-OXIMETER.
- Patient simulator has been used to verify the accuracy of PR. Calculating the root mean square of the difference between the pulse rate measurement value and the patient simulator setting value to indicate the PR accuracy.

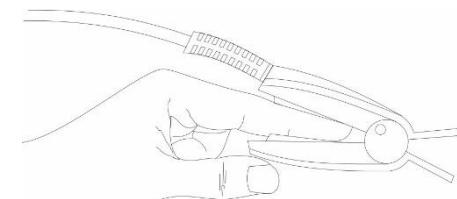
11.2 Safety Information

⚠️ WARNING

- The equipped SpO₂ probe is only suitable for use with this device. This device can only use the SpO₂ probe specified in this manual. It is the responsibility of the operator to check the compatibility of the device and the SpO₂ probe before use. Incompatible accessories may result in device performance decreasing or cause injury to the patient.
- Use only the SpO₂ probe specified in this manual, and use it in accordance with the user manual, and observe all warnings and precautions.
- When the patient is prone to hypoxia, an oximeter should be used to analyze the blood sample to fully grasp the patient's condition.
- Avoid using monitors and sensors when using MRI equipment, because the induced current may cause severe burns to the patient.
- During continuous long-term monitoring of the patient, the position applied with SpO₂ probe should be checked every 2 hours, and appropriate movements should be made when the skin changes or every 4 hours. Some patients may require more frequent examinations, such as newborns, patients with perfusion disorders, or sensitive skin. Because continuous and long-term monitoring may increase unpredictable skin changes, such as allergies, redness, blistering, or pressure necrosis.
- For some special patient who need a more careful inspection on the test site, please do not place the device on the edema or tender tissue.
- Please do not stare at the red and infrared light emitter (the infrared light is invisible) after turning on the device, including the maintenance staff, as it may be harmful to the eyes.
- The person who is allergic to silicone, PVC, TPU, TPE or ABS cannot use this device.
- Some models of functional tester or patient simulator can measure the accuracy of the device that reproduces the calibration curve, but it cannot be used to evaluate the accuracy of this device

11.3 Monitoring Steps

1. Select the appropriate pulse oximetry probe according to the module type, patient type and body weight.
2. Clean the measuring parts, such as colored nail polish.
3. Place the probe of pulse oxygen probe on the patient.



4. Select the extension cable and connect according to the SpO₂ interface type of the module.
5. Connect the pulse oximetry probe to the extension cable.

11.4 SpO₂ Setup

11.4.1 Open the SpO₂ Menu

You can open the SpO₂ menu in the following ways:

- Select the SpO₂ parameter area to open the "SpO₂ Setup" menu.
- Select "Main Menu" - "Measurement SETUP" - "SpO₂ Setup" to open the "SpO₂ Setup" menu.

11.4.2 Set alarm limit

Select "Alarm Settings >>" in the "SpO₂ Setup" menu. In the pop-up menu, you can set the alarm switch, alarm high limit, alarm low limit and recording switch of "SpO₂". When the measured value of SpO₂ is lower than the set alarm low limit or higher than the set alarm high limit, and the alarm is "On", medium or high physiological alarm is triggered, prompting "SpO₂ is too low < alarm low limit" or "SpO₂ is too high > alarm low limit".

11.4.3 Set sensitivity level

You can set "Sensitivity" to "High", "Medium", or "Low" in the "SpO₂ Setup" menu. When the sensitivity is set to "high", the monitor is more sensitive to the recognition of tiny signals. When monitoring critically ill patients, the patient's pulse is very weak, so the sensitivity should be set to "high". When monitoring neonates or non-severe patients, if the patient moves noise or invalid small signals may be generated, so the sensitivity should be set to "medium" or "low" to filter out movement interference and make the measurement more stable.

11.4.4 NIBP same side setup

When NIBP and SpO₂ are measured on the same limb of the patient, the "NIBP same side" should be set to "On" in the "SpO₂ Setup" menu to ensure that the physiological alarm state of SpO₂ remains unchanged during NIBP measurement until the NIBP measurement is completed. If it is set to "off", the weak perfusion caused by NIBP measurement will lead to inaccurate SpO₂ measurement and trigger the physiological alarm of SpO₂.

11.4.5 Set Pleth waveform speed

You can set "Waveform Speed" in the "SpO₂ Setup" menu. The larger the value, the faster the scanning speed and the wider the waveform.

11.4.6 Set SpO₂ probe fall-off alarm level

Select "Alarm Setup >>" in the "User Maintenance" menu, and then set "SpO₂ fall-off level" in the pop-up menu.

11.5 Measurement Influencing Factors

If you doubt the accuracy of the measurement results, please use other methods to check the patient's vital signs first, and then check the monitor and pulse oxygen probe. During the measurement, the following factors may affect the accuracy of the measurement:

- External light radiation
- Body movement (active or passive movement of the patient)
- Diagnostic Test
- Weak perfusion
- Influence of electromagnetic fields, such as nuclear magnetic resonance equipment
- Electrosurgical equipment
- Concentration of non-functional hemoglobin, such as carbohemoglobin (COHb) and positive iron hemoglobin (MetHb)
- The presence of certain dyes, such as methylene blue and carmine indigo.
- The pulse oximetry probe is not positioned properly or an incorrect pulse oximetry probe is used.
- Shock, anemia, hypothermia or the application of vasoconstrictive drugs cause arterial blood flow to drop to unmeasurable levels.

Chapter 12 NIBP

12.1 Introduction

This monitor uses oscillometry method to measure non-invasive blood pressure (NIBP). It is applicable for adult, pediatric and neonate. In order to know how the oscillometry works, we compare it with auscultatory method.

- Auscultatory method: the doctor listens the blood pressure by the stethoscope, to obtain the systolic pressure and diastolic pressure. When the artery pressure curve is normal, the mean pressure can be calculated by the systolic pressure and diastolic pressure
- Oscillometry method; the blood pressure cannot be listened by the monitor, it measures the vibration amplitude of cuff pressure. Cuff vibration appears when the blood pressure changes, the cuff pressure corresponding to the maximum amplitude is the mean pressure. The systolic and diastolic pressure can be calculated by the mean pressure.

In a word, the auscultatory method measures the systolic and diastolic pressure, then calculates the mean pressure. And the oscillometry measures the mean pressure, then calculates systolic and diastolic pressure. According to IBC 60601-2-30/EN 60601-2-30, NIBP measurement can be performed during electrosurgery and defibrillator discharge. The clinical meaning for NIBP measurement must be determined by the physician.

12.2 Safety Information

WARNING

- Before measuring, make sure the type of your patient. False settings may imperil patient's safety, as higher adult settings are not suitable for pediatric and neonate.
- You must not perform NIBP measurement on patients with sickle-cell disease or under any condition which the skin is damaged or expected to be damaged.
- For the patients with severe clotting mechanism abnormality, please determine whether automatically measure the blood pressure according to the clinical evaluation, as the rub position between the limb and cuff will have the risk of producing hematoma.
- Do not apply the cuff to a limb that has an intravenous infusion or catheter. This could cause tissue damage around the catheter when infusion is slowed or blocked during cuff inflation.
- If you are in doubt about the accuracy of any reading, check the patient's vital signs by an alternative method before checking the functioning of the monitor.
- Do not use the cuff on the side of the mastectomy or lymph node dissection.

- Do not use the cuff on the injured area, otherwise it will cause more serious damage to the injured area.
- Do not twist or tangle the airway tube, otherwise it will cause continuous pressure in the cuff, then causing blocked blood flow and serious injury to the patient.
- Do not use the cuff on the site where intravascular treatment is being performed or with catheter connection, otherwise it may cause temporary blockage of blood flow and then cause injury to the patient.
- The pressure by cuff may cause temporary weakness of some functions of the body, so do not use monitoring medical electrical equipment on the corresponding arm.

12.3 Measurement Limitations

NIBP measurement cannot be done on the patients with extreme heart rate (lower than 40 bpm or higher than 240 bpm) or connecting with heart-lung machine.

The measurement may be inaccurate or cannot be done in the following conditions:

- Difficult to detect regular arterial pressure pulsation
- Excessive or continuous patient movement, such as shivering or convulsions
- Cardiac arrhythmia
- Rapid pressure change
- Severe shock or hypothermia decreases the blood flowing to the peripheries.
- On edematous limbs

12.4 Measurement Modes

There are four measurements methods:

- Manual: NIBP measurement is performed manually when necessary.
- Automatic: The monitor can automatically and repeatedly measure NIBP according to the set time interval.
- Continuous measurement: Continuous measurement is carried out within 5 minutes, and then the monitor returns to the original mode.
- Series measurement: during the period set in the series measurement, the measurements are taken according to the duration and measurement interval of each stage, and then the monitor returns to the original mode.

12.5 Measurement Steps

12.5.1 Measurement Preparations

1. If the monitor is turned off, turn on the power supply of the monitor.

2. Confirm the patient type, if it is false, please change.
 3. Connect the airway tube with the blood pressure cuff interface.
 4. Select the cuff, make sure the cuff is completely deflated, then apply the cuff to the patient's upper arm or leg.
 - Confirm the limb perimeter of the patient.
 - Choose the appropriate cuff (the cuff is marked with the applicable limb perimeter). The width of the cuff should be either 40% of the limb circumference (50% for neonates) or 2/3 of the upper arm length. The inflatable part of the cuff should be long enough to encircle 50-80% of the limb.
 - Apply the cuff to the patient's arm or leg, and make sure that the symbol " φ " exactly locates to the artery. Ensure that the cuff is not wrapped too tightly around the limb, otherwise it will cause discoloration or ischemia of the limb. The edge of the cuff should be within the marked range, otherwise the cuff should be replaced.
- Connect the cuff to the airway tube. Make sure that the airway tube is neither blocked nor tangled.

NOTE

- The patient should not move or speak during the measurement blood pressure

12.5.2 Start/Stop Measurement

You can select the NIBP measurement to be carried out in "NIBP Setup", or use the "NIBP start/stop" hot key on the screen to start NIBP measurement. You can use the "Stop Measurement" hot key on the screen to stop NIBP measurement in all modes.

12.5.3 Auto Measuring

1. Select the NIBP parameter area to open the "NIBP Setup" menu.
2. Set "Interval" to options other than "Manual".
3. The first measurement is started manually, after finishing, the system will automatically and repeatedly measure according to the interval time.

12.5.4 Continous Measuring

1. Select the NIBP parameter area to open the "NIBP Setup" menu.
2. Select "Continue Measuring" item to start a continuous measurement. The process will continue 5 minutes.

12.5.5 Correct Measurement Result

Keep the limb to be measured and the patient's heart on the same horizontal position, otherwise, amend the measurement results by the following method:

- If the cuff is higher than the horizontal position of the heart, then the displayed value should add 0.75mmHg (0.10 kPa) per lem difference.
- If the cuff is lower than the horizontal position of the heart, then the displayed value should subtract 0.75mmHg (0.10 kPa) per lem difference.

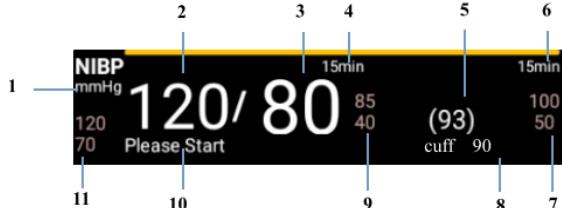


WARNING

- In auto or continuous mode, if the time is too long, then the limb rubbed with the cuff may appear purpura, ischemia and nerve injury. So when monitoring the patient, patient's limb color, warmth and sensitivity should be checked frequently. Once any abnormality appears, please replace the cuff or stop the NIBP measurement.
- Do not leave the cuff under over-inflated state for long time, otherwise there may be risks.

12.6 NIBP Display

There is no waveform for NIBP measurement, it only displays the NIBP measurement results in the parameter area. The following figure is only used for reference, your monitor may display a different interface.



1. Unit: mmHg or kPa
2. Systolic pressure
3. Diastolic pressure
4. Interval measurement time countdown
5. Mean pressure
6. Time to next automatic measurement
7. Alarm high limit and low limit of MEAN pressure
8. Prompt information area: display the prompt information related to the NIBP.

9. Alarm high limit and low limit of Diastolic pressure
10. Measurement mode
11. Alarm high limit and low limit of Systolic pressure

12.7 NIBP Setup

Select the NIBP parameter area to open the "NIBP Setup" menu.

12.7.1 Set the initial inflation pressure

You can manually set the initial inflation pressure of the cuff. Open the "NIBP Setup" menu and select the appropriate cuff pressure value in "Initial Inflation Pressure".

12.7.2 Set the alarm properties

In the "NIBP Setup" menu, select "Alarm Setup >>", and then set the alarm properties in the pop-up menu.

12.7.3 Display NIBP List

The latest measurement results can be viewed in NIBP list, including systolic pressure, diastolic pressure, mean pressure, pulse rate value and measurement time. The figure below is for reference only. The graphics displayed on your monitor may be slightly different. The PR value comes from NIBP measurement.

NIBP List	Sys/Dia	Mean	PR	Time
mmHg	120/80	93	80	13:51:28

In some interfaces, NIBP cannot be displayed in "NIBP List", such as the trend coexistence interface.

12.7.4 Set pressure unit

Select "Unit Setup" in the "User Maintenance" menu, and set the "Pressure Unit" to "mmHg" or "kPa" in the pop-up menu.

12.8 Auxillary venipuncture

Users can use NIBP cuff to inflate to form a pressure close to diastolic pressure, block the venous vessels and assist in the completion of venipuncture.

1. In the "NIBP Setup" menu, select "Auxiliary Venipuncture >>" and confirm the value of "Venipuncture Pressure" in the pop-up menu. If not, adjust to the appropriate value.

2. Select "Auxiliary Venipuncture".
3. Puncture vein and draw blood sample.
4. Select the "Stop Venipuncture" key to deflate the cuff. If the cuff is not deflated, the cuff will automatically deflate after a certain set time.

During puncture, the NIBP parameter area will show the inflation pressure of cuff.

12.9 Series Measurement

1. In the "NIBP setup" menu, select "Order Setup >>", and set the duration and measurement interval of each stage in the pop-up menu.
2. In the "NIBP setup" menu, select "Start Order" to start the series measurement.
3. After starting the series measurement, select "Stop All" key in the "NIBP setup" menu to stop the measurement.

Chapter 13 TEMP Monitoring

13.1 Introduction

The temperature module can support 2-channel temperature measurement. The measurement adopts armpit measurement method, and the minimum measurement time is 10 minutes.

NOTE

- The self-test of the temperature measurement is performed automatically at least once per minute during monitoring. The test procedure lasts about 2s, which does not affect the normal measurement of the monitor.
 - The calibration of the temperature measurement is necessary for every two years (or as frequently as dictated by your Hospital Procedures Policy). When you need calibrate the temperature measurement, contact the manufacturer please.
-

13.2 Safety Information

⚠ WARNING

- Verify whether the probe cable is normal before monitoring. Unplug the temperature probe cable of channel 1 or 2 from the socket, the audible alarm is activated and the screen will display the error message “T1/T2 TEMP OFF”.
-

13.3 Measurement Steps

Please refer to the following steps:

1. Select an appropriate TEMP probe according to patient type and measurement requirement.
2. If a disposable probe is used, connect the probe to the extension cable.
3. Insert the probe or extension cable into the TEMP probe interface.
4. Attach the TEMP probe to the patient properly.
5. Confirm that the alarm settings are suitable for the patient.

13.4 TEMP Display

The monitor can display the temperature of the two channels (T1 and T2) and the difference between them. Select the Temp parameter area to open the "Temp Setup" menu.



13.5 Set Temperature Unit

Click "Unit Setup" in the "User Maintenance" menu to set "Temperature Unit" to "C" or "F" in the pop-up menu.

Chapter 14 IBP

14.1 Introduction

You can use multi-parameter plug-ins and IBP modules for IBP measurement. The monitor can provide 4-channel IBP measurement and display waveform, systolic pressure, mean pressure and diastolic pressure for each channel.

14.2 Safety Information

WARNING

- Use only the pressure transducer listed In the User Manual. Disposable IBP transducer should not be reused.
- The operator should avoid contact with the conductive parts of the appurtenance when it is connected or applied.
- When the monitor is used with HF surgical equipment, the transducer and the cables must be avoided from conductive connection to the HF equipment. This is to protect against burns to the patient.
- When applying the accessories, the operating temperature requirements of accessories should be considered, please refer to the operating instructions of accessories

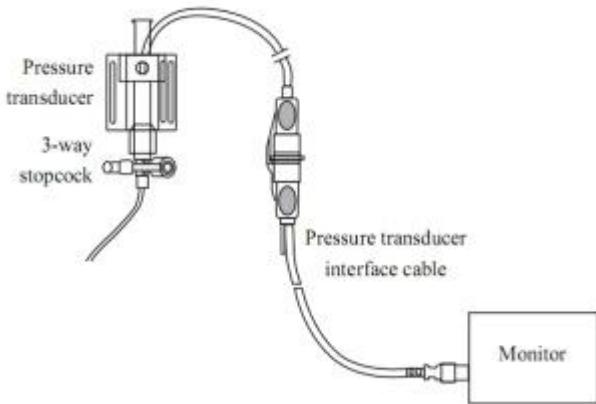
14.3 IBP pressure zero

The monitor requires a valid zero point to obtain an accurate pressure rendering. Please calibrate the sensor according to the requirements of the hospital (at least once a day). The zero operations must be performed in following conditions:

- When using a new sensor or sensor cable.
- When re-connecting the sensor cable and the monitor.
- When the monitor is restarted.
- When you doubt that the monitor pressure reading is inaccurate.

Calibration steps are as followings:

1. Turn off the valve from the 3-way stopcock to the patient.



2. The transducer must be vented to atmospheric pressure via the 3-way stopcock.
3. Take the channel 1 as an example, select "IBP Setup" - "IBP Pressure Zero" - "CH1 Zero", then select it to calibrate.
4. When the information "CH1 Successful Zero." appears, close the valve to the atmospheric pressure and open the valve to the patient.

NOTE

- Hospital regulations may require ICP sensors to be zero-calibrated less frequently than other sensors.

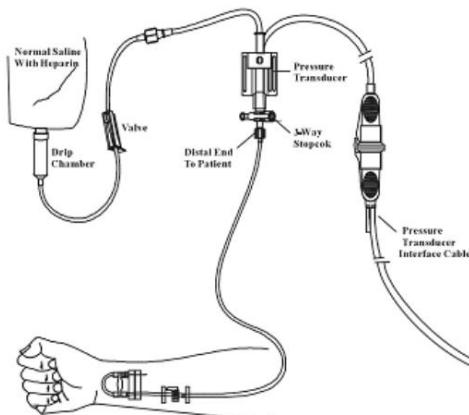
14.4 Monitoring Steps

1. Insert the pressure sensor cable into the IBP interface.
2. Prepare the rinse solution.
3. Rinse the system, exhaust all air in the pipeline. Make sure there are no air bubbles in the sensor or the valve.

⚠ WARNING

- If there are air bubbles in the pipeline, you should rinse the system with solution again. As air bubble may cause false pressure reading.

4. Connect the patient eatheter to the pressure pipe.
5. Place the sensor at the same level as the heart, about the middle-axillary line.
6. Select a correct label name.
7. Zero the transducer. After zeroing successfully, turn off the valve from the transducer to atmospheric pressure, and turn on the valve to the patient.



monitor

! WARNING

- When measuring intracranial pressure of a sitting patient, the sensor should be level with the top of the patient's ear. Incorrect position will lead to an inaccurate result.

14.5 IBP Display

Invasive blood pressure measurement displays pressure waveforms and pressure values on the interface. The following figure shows the pressure waveform and parameters of ART. The display may be different for different pressures.

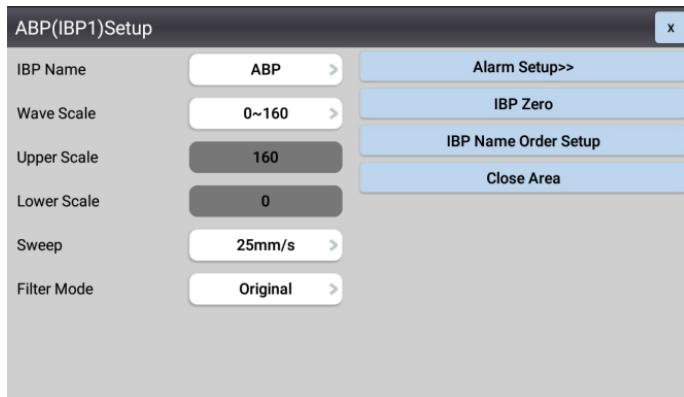


1. Waveform
2. Pressure unit
3. Systolic pressure
4. Diastolic pressure
5. Mean pressure

14.6 IBP Setup

14.6.1 Change pressure label name

1. Select the BP parameter area where the label name needs to be changed, and open the setup menu. There is a schematic diagram of the current measurement channel in the menu.



2. Select “IBP Pressure Label Name” and select the appropriate label name in the list

Label Name	Definition	Label Name	Definition
PA	Pulmonary Arterial Pressure	CVP	Center Venous Pressure
ART	Arterial Blood Pressure	ICP	Intracranial Pressure
LAP	Left Atrial Pressure	P1	Expand Pressure
RAP	Right Atrial Pressure	P2	Expand Pressure

NOTE

- When the monitor detects the same pressure name, it will automatically change one of them to an unused pressure name.

14.6.2 Set alarm properties

In the parameter setting menu, select "Alarm Setup >>", and then set the alarm properties in the pop-up menu.

14.6.3 Set pressure unit

Select "Unit Setup" in the "User Maintenance" menu, and set the "Pressure Unit" to "mmHg" or "kPa" in the pop-up menu. "CVP Unit" can be separately set to "mmHg", "cmH₂O" or "kPa".

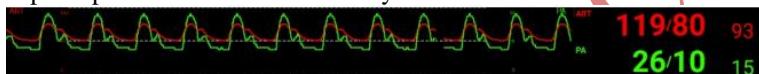
14.6.4 Set IBP waveform

- Select an IBP parameter area and open the corresponding setup menu.

- Select "Waveform Speed": Select the appropriate setting in the pop-up list. The larger the value, the faster the scanning speed and the wider the waveform.
- Select "Waveform Ruler": Select the appropriate setting in the pop-up list. If "Automatic" is selected, the upper and lower scales of IBP waveform will automatically adjust with the change of waveform amplitude.
- Select "filter", and then select the required filter settings.

14.6.5 IBP waveform superposition

By setting the parameter display operation, IBP is superimposed and displayed (first turn off the parameters at the position to be displayed, then select "IBP Superposition" to display IBP superposition). IBP superposition superimpose two IBP waveforms by default.



Chapter 15 CO₂

15.1 Introduction

The device adopts infrared absorption technology to measure the CO₂ concentration in the patient's breathing airway. The principle is that the CO₂ molecules can absorb the infrared energy with specific wavelength, and the amount of energy absorbed is directly related to the CO₂ concentration. When the infrared light emitted by the infrared light source penetrates the CO₂ sample, part of the energy will be absorbed by the CO₂ in the gas. On the other side of the infrared light source, use a photodetector to measure the residual infrared light energy which will be converted into the electrical signal. Comparing and adjusting the electrical signal and infrared light energy to accurately reflect the CO₂ concentration in the gas sample.

CO₂ measurement methods:

1. Mainstream

Install the CO₂ sensor to the airway joint of respiratory system connected to the patient directly.

2. Sidestream

The respiratory gas in the patient's respiratory airway was sampled using a constant sampling flow rate and analyzed by a built-in CO₂ sensor.

NOTE

- When the temperature of sampling gas is 37°C, room temperature is 23°C, relative humidity is 100%, and the sampling flow rate is 50ml/min, the drying tube reaches to saturation condition after 72 hours. In normal clinical condition, the usable time of drying tube may be longer, but it should be replaced when its color changed.

CO₂ measurement can provide:

1. One-channel CO₂ waveform.
2. EtCO₂: End Tidal carbon dioxide, CO₂ value measured in the end of respiratory phase
3. InsCO₂: Inspired Minimum CO₂
4. AwRR: Air Way Respiratory Rate, respiratory times per minute.
5. Connect for CO₂ transducer



15.2 Preparing to Measure CO₂

15.2.1 Sidestream CO₂ Module

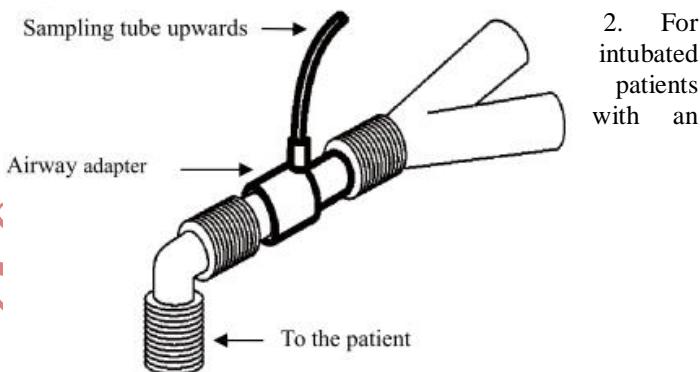
1. Take "Lord Rouse" to connecting for CO₂ connector for sampling line in patient monitor .
2. In "CO₂ SETUP"- "Operating Mode' set up for" Measurement".

3. After start-up is finished, the CO2 module needs time to warm up to reach the operating temperature.
The message [CO2 Sensor Warmup] is displayed. If you perform CO2 measurements during warm-up, the measurement accuracy may be compromised.
4. After warm-up is finished, you can perform CO2 measurements.
 - Sidestream connector for sampling line



Connection for sidestream and intubated patient

1. For the intubated patient, when using the airway adapter, install the adapter to the near-end of the loop, between the elbow bend and ventilator Y tube, as shown below.



integrated airway respiration adapter in the breathing circuit: connect the luer male head on the sampling tube to the concave port of the airway adapter.

**NOTE**

- Disconnect the cannula, airway adapter, or sampling tube from the sensor when it is not used.
- Before connecting the 3-way stopcock to the breathing circuit, make sure to properly connect the airway adapter and the sensor. Conversely, before removing the sensor, be sure to remove the airway adapter from the breathing circuit.
- Check the airway adapter before using it. If the airway adapter is already damaged or destroyed, do not use it.
- Do not use the device in an environment with flammable anesthetic gas.
- Only professionals who have received technical training and are familiar with this manual can operate the device.
- Accessories should be replaced following good clinical practice or when the monitor prompts a blockage. When the sampling air flow rate is low, the blockage has occurred, and the monitor will send out a prompt message.
- When the sampling system of the module is blocked, first check whether the sampling pipes are entangled.
- The CO2 module does not require daily calibration.

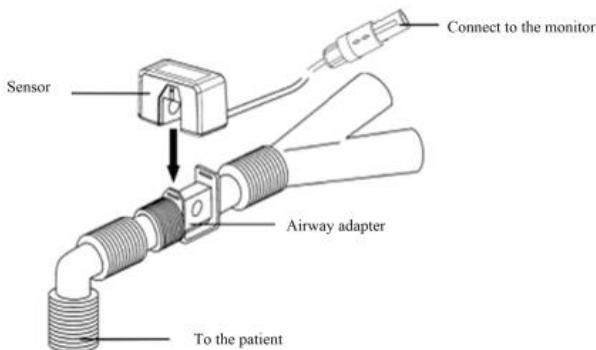
During measuring, if the tube falls off, it is necessary to re-calibrate after connecting well for further measurement.

15.2.2 Measurement setting for mainstream CO2 Module

NOTE

- When using a new airway adapter, it must be zeroed as described in this section.

1. Connect the sensor to the CO₂ module.
2. The information "CO₂ SENSOR WARM UP" will display on the screen.
3. After warm up, connect the sensor to the airway adapter.
4. Refer to relative chapter for zeroing the sensor.
5. After zeroing, connect the gas circuit as the following figure.

**NOTE**

- **Install the sensor above the adapter to prevent the liquid from gathering on the adapter window. The high concentration or liquid at this location will hinder the gas analysis.**

15.3 Changing CO2 Settings

15.3.1 Accessing CO2 Menus

You can open the CO₂ menu in the following ways:

- Select the CO₂ parameter area and open the " CO₂ SETUP" menu.
- Select "MAIN MENU"- "MEASUREMENT SETUP"- " CO₂ SETUP" to open the "CO₂ SETUP" menu.

15.3.2 Setting the CO2 Unit

Select [Unit Setup >>] from the [User Maintenance] menu. In the popup menu, select [CO₂ Unit] and toggle between [mmHg], [%] and [kPa].

15.3.3 Setting up Gas Compensations

⚠ WARNING

- **Make sure that the appropriate compensations are used. Inappropriate compensations may cause inaccurate measurement values and result in misdiagnosis.**

For the mainstream CO₂ module, in the [CO₂ Setup] menu, respectively select:

- [Balance Gas] and toggle between [Room Air] and [N₂O]. Select [Room Air] when air predominates in the ventilation gas mixture and select [N₂O] when N₂O predominates in the ventilation gas mixture and select [He] when He predominates in the ventilation gas mixture.

- [O₂ Compen] and then select [Off] or an appropriate setting according to the amount of O₂ in the ventilation gas mixture. When the amount of O₂ is less than 30%, you'd better switch this compensation off.
- [AG Compen] and enter the concentration of anesthetic gas present in the ventilation gas mixture. This could compensate for the effect of AG on the readings.

15.3.4 Setting the Apnea Alarm Delay

In the [CO₂ Setup] menu, select [Apnea Delay] and then select the appropriate setting. The monitor will alarm if the patient has stopped breathing for longer than the preset apnea time. The [Apnea Delay] of Resp, and CO₂ keeps consistent with each other.

15.3.5 Setting up the CO₂ Wave

Open "Main Menu"- "Display Setup" menu:

In the " CO₂Waveform Fill Setup" setting:

[Draw]: The CO₂ wave is displayed as a curved line.

[Fill]: The CO₂ wave is displayed as a filled area.

Open the " CO₂ Setup" menu:

"Sweep": select the appropriate setting. The larger the value is set, the faster the wave sweeps, and the wider the wave is.

" CO₂ Scale": Change the waveform amplitude by adjusting the scale on the waveform.

15.3.6 Setting RR Source

To set RR source:

1. Enter the [CO₂ Setup] menu.
2. Select [RR Source] and then select a source or [Auto] from the dropdown list.

The [RR Source] settings of Resp, CO₂ module are linked. For details, please refer to the section Setting RR Source of chapter Resp.

15.4 Setting Barometric Pressure Compensation

Both sidestream and microstream CO₂ modules have the function of automatic barometric pressure compensation (the system automatically measures the barometric pressure which the patient monitor is exposed to). However, the mainstream CO₂ module does not have such function. For the mainstream CO₂ module, the default barometric pressure is 760 mmHg. You must modify the barometric pressure based on the actual situation as follows:

1. Select [Main Menu] - [Maintenance] - [Factory Maintenance], enter the password.

-
2. Input CO₂ calibration concentration, press the "Calibration" button to calibrate.
 3. Select [Barometric Pressure] and then enter the value of barometric pressure to which the patient monitor is exposed to.
-

WARNING

- Be sure to set the barometric pressure properly before using the mainstream CO₂ module. Improper settings will result in erroneous CO₂ reading.
-

15.5 Measurement Limitations

The following factors may influence the accuracy of measurement:

- Leaks or internal venting of sampled gas
- Mechanical shock
- Cyclic pressure up to 10 kPa (100 cmH₂O)
- Interfering gas or steam
- Other sources of interference, if any

15.6 Removing Exhaust Gases from the System

WARNING

- **Anesthetics:** When using the Sidestream or Microstream CO₂ measurement on patients who are receiving or have recently received anesthetics, connect the outlet to a scavenging system, or to the anesthesia machine/ventilator, to avoid exposing medical staff to anesthetics.

To remove the sample gas to a scavenging system, connect an exhaust tube to the gas outlet connector of the module.

15.7 Zeroing the Sensor

The zero calibration eliminates the effect of baseline drift during CO₂ measurement exerted on the readings and therefore maintains the accuracy of the CO₂ measurements.

You can also start a manual zero calibration if necessary. To manually start a zero calibration, select [Maintain CO₂ >>] from the [User Maintenance] menu.

Each time you use a new airway adapter, to zero the sensor, follow this procedure:

1. Connect the sensor to the module.

2. In the [CO₂ Setup] menu, set the [Operating Mode] to [Measure]. The message [CO₂ Sensor Warmup] is displayed.
3. After warm-up is finished, connect the sensor to a clean, dry airway adapter. The adapter should be vented to the air and isolated from CO₂ sources, such as ventilator, the patient's breathing, your own breathing, etc
4. Select [Start Zero Cal] in the [CO₂ Setup] menu. The message [CO₂ Zero Running] is displayed.
5. It takes about 6 to 10 seconds. The message disappears when the zero calibration is completed.



WARNING

- **When perform a zero calbraion during the measurement, disconnect the transducer from the patient's airway first.**

NOTE

- **Each time you use a new airway adapter, must to zero the sensor follow this content.**

15.8 Calibrating the Sensor

For sidestream or microstream CO₂ modules, a calibration should be performed once every year or when the readings go far beyond the range. For mainstream CO₂ modules, no calibration is required. For details, refer to the chapter Maintenance.

Chapter 16 Freeze

When monitoring a patient, you can freeze the waveform on the screen and then review it carefully so that you can observe the patient's condition in detail. The frozen waveform can be output through the recorder.

16.1 Enter Freeze Status

1. In the Non-Freeze status, press the "FREEZE" hot key.
2. All waveforms are frozen. In other words, the system will no longer refresh the waveforms, while the data in the parameter area is refreshed normally.

Freezing does not affect:

- Display and refresh the dynamic short trend chart under the short trend interface.
- Display and refresh of respiratory oxygenation chart.
- Display and refresh of other observation window.

16.2 Waveform reviewing

In the condition of freeze status, you can slide the screen left or right to move the frozen waveform correspondingly.

16.3 Exit freeze status

In the Freeze status, executing any of the following operations to exit the Freeze status:

- Press the "FREEZE" hot key again.
- Execute any operation that may trigger the re-adjustment of the screen or display of a new menu. For example: Plug and unplug the module.

16.4 Record frozen waveform

Select the "RECORD" button when the waveform is frozen, and the recorder will output the selected waveform and the parameter value of freezing time.

Chapter 17 Reviewing

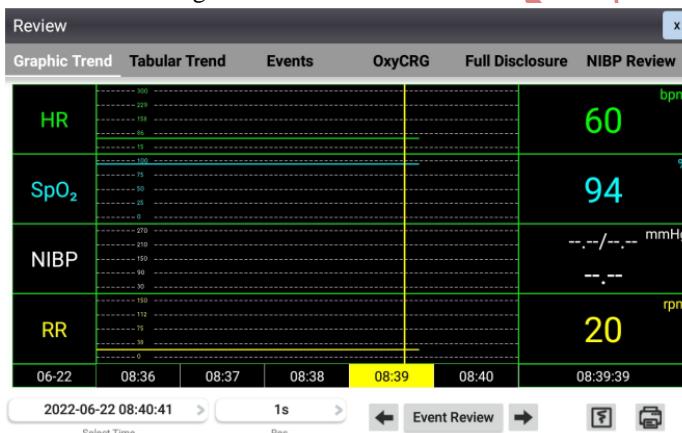
17.1 Opening review window

1. Select "DATE REVIEW" hot key or "REVIEW" in the "MAIN MENU".
2. Select "TREND CHART", "TREND TABLE", "EVENT", "HOLOGRAPHIC WAVEFORM", "RESPIRATORY OXYGENATION", "BLOOD PRESSURE REVIEW ", "12 LEAD REVIEW" to open the corresponding review window.

For a description of the results of the 12 lead analysis, refer to the ECG section.

17.2 Review trend data

Select "GRAPHIC TREND" item in "REVIEW", and you can enter the window shown in the figure below.



- Select the parameter name on the left side of the trend chart and select the parameter to observe the trend in the pop-up menu.
- Select "START TIME " to set the start time of trend review.
- Select "RESOLUTION", and choose according to observation needs:
 - "1 second", "5 seconds "or "10 seconds": Observe the latest trend with the resolution of 1 second, 5 seconds or 10 seconds.
 - "1 minute", "5 minutes "or "10 minutes": Observe the latest trend with the resolution of 1 minute, 5 minutes or 10 minutes.
- In the trend chart area, swipe left or right to page forward or backward to view the trend chart
- In the trend chart area, click on the left side of the trend cursor to move the trend cursor to the left; Click on the right side of the trend cursor to

move the trend cursor to the right. The current corresponding time of the trend cursor is displayed in the lower right corner. The right side of the trend graph displays the parameter values at the position of the trend cursor, which will automatically change as the trend cursor moves. The background color of parameters causing high-level alarm is red, and that of medium-level and low-level alarm is yellow.

- Select "←" and "→" buttons on both sides of "EVENT" to quickly locate the cursor to the moment when the event occurs.
- Select the record icon to record the trend graph displayed in the current window.
- Select the print icon to set and print the trend graph report. Please refer to the print chapter as for how to set the trend graph report.

17.3 Review tabular trend

Select "TABULAR TREND" in the "REVIEW" menu to quickly enter the windows below.

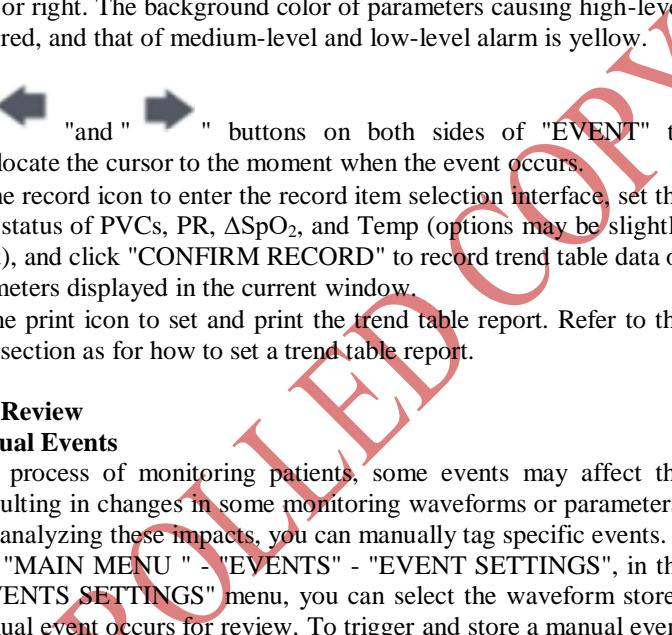


Graphic Trend	Tabular Trend	Events	OxyCRG	Full Disclosure	NIBP Review
06-22	08:18:24	08:23:24	08:28:24	08:33:24	08:38:24
HR (bpm)	60	60	60	60	60
PVCs (/min)	0	0	0	0	0
ST-I (mV)	0.14	0.14	0.14	0.14	0.14
ST-II (mV)	0.20	0.20	0.20	0.20	0.20
ST-III (mV)	0.08	0.08	0.08	0.08	0.08
ST-aVR (mV)	-0.16	-0.16	-0.14	-0.16	-0.16
ST-aVF (mV)	0.14	0.14	0.14	0.14	0.14
ST-aVL (mV)	0.04	0.04	0.04	0.04	0.04

2022-06-22 08:38:24 5min Select Time Res. Event Review Print

- Select "START TIME" to set the start time of trend review.
- Select "RESOLUTION", and choose according to observation needs:
 - "5 seconds" or "30 seconds": Observe the latest trend with the resolution of 5 seconds or 30 seconds
 - "1 min", "5min", "10min", "15min" or "30min": Observe the latest trend with the resolution of 1 minute, 5 minutes, 10 minutes, 15 minutes or 30 minutes.
 - "1 hour", "2 hour" or "3 hour": Observe the latest trend with the resolution of 1 hour, 2 hours or 3 hours.

- Select the record icon to enter the record item selection interface, set the printing status of parameters to be recorded in the pop-up menu, and click "CONFIRM RECORD" to record trend table data of all parameters during the time period displayed in the current window.
- You can swipe up and down to view the trend table. Slide left and right to turn left or right. The background color of parameters causing high-level alarm is red, and that of medium-level and low-level alarm is yellow.

- 
- Select "←" and "→" buttons on both sides of "EVENT" to quickly locate the cursor to the moment when the event occurs.
 - Select the record icon to enter the record item selection interface, set the printing status of PVCs, PR, ΔSpO₂, and Temp (options may be slightly different), and click "CONFIRM RECORD" to record trend table data of all parameters displayed in the current window.
 - Select the print icon to set and print the trend table report. Refer to the printing section as for how to set a trend table report.

17.4 Event Review

17.4.1 Manual Events

In the process of monitoring patients, some events may affect the patients, resulting in changes in some monitoring waveforms or parameters. To assist in analyzing these impacts, you can manually tag specific events.

Select "MAIN MENU" - "EVENTS" - "EVENT SETTINGS", in the pop-up "EVENTS SETTINGS" menu, you can select the waveform stored when a manual event occurs for review. To trigger and store a manual event at the same time, you can select the "MANUAL EVENTS" hot key or select "TRIGGER MANUAL EVENTS" in the "EVENTS" menu.

When reviewing trend graphs and trend tables, corresponding marks will be displayed at the moment when a manual event occurs.

17.4.2 Events Review

The monitor can save events in real time, and users can review the saved events.

Select "EVENTS" in the "REVIEW" menu to enter the "EVENTS" window shown in the figure below. The events that can be reviewed include parameter alarm events, arrhythmia alarm events and manual events. When an event occurs, the monitor will store the values of related parameters at the time of occurrence, as well as the relevant waveforms of 4 seconds, 8 seconds or 16 seconds before and after the occurrence time, so that the user can review the event. The waveform storage time is determined by the record length setting.

Review		X			
Graphic Trend	Tabular Trend	Events	OxyCRG	Full Disclosure	NIBP Review
2020-09-18-15:36:01				**SpO ₂ Too High > 96	
2020-09-18-15:35:46				**IBP2_DToo Low < 50	
2020-09-18-15:35:46				**IBP2_MToo Low < 70	
2020-09-18-15:35:46				**IBP2_SToo Low < 90	
2020-09-18-15:35:41				**IBP_DToo High > 70	
2020-09-18-15:35:41				**IBP_MToo High > 90	
2020-09-18-15:35:40				✓ T2 Sensor Off	
2020-09-18-15:35:40				✓ T1 Sensor Off	
2020-09-18-15:35:04				✓ **awRRToo Low < 8	
2020-09-18-15:35:04				✓ **EtCO ₂ Too Low < 25.0	
2020-09-18-15:35:00				✓ ECG Lead Off	
2020-09-18-15:35:00				✓ IBP2 Sensor Off	
2020-09-18-15:35:00				✓ IBP1 Sensor Off	
2020-09-18-15:34:57				✓ SpO ₂ Sensor Off	

Detail

All

Type

All

Level

- Select event type: Select the event type to be reviewed in the list of "TYPES" as required
- Select event level: Select the event level to be reviewed in the list of "LEVEL" as required

NOTE

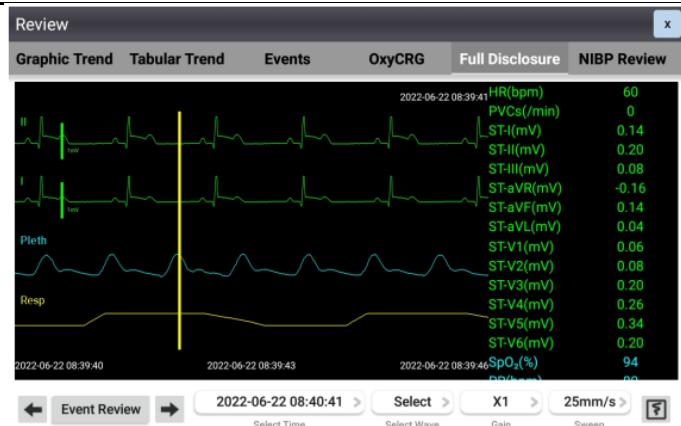
- **The power failure of the monitor has no effect on the stored events**

After selecting an event, select "DETAILED INFORMATION" to enter the window shown in the figure below. The waveform area will display the waveform related to the event, and the parameter area will display the parameter values related to the moment the event occurs.

- Swipe left and right in the waveform display area to move the waveform.
- Select "◀" and "▶" buttons on both sides of "EVENT" to switch to the corresponding event.
- Select "GAIN" to change the gain of ECG waveform.
- Select "TRAVELING SPEED" to change the wave speed of 3 waveforms at the same time.
- Select the record icon to record the currently selected alarm event.
- Select the print icon to print the currently selected alarm event.
- Select "EVENTS LIST" to display the events that have occurred in a list.

17.5 Full disclosure waveform reviewing

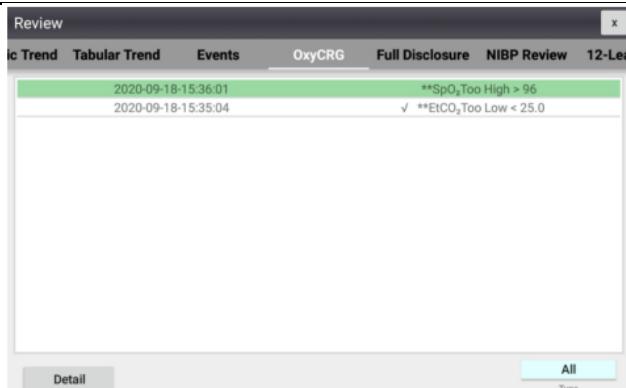
Select "FULL DISCLOSURE" in the "REVIEW" menu to enter the window shown in the figure below.



- Click the screen on the left and right sides of the waveform cursor to move the waveform cursor. Slide left or right in the waveform area to move the waveform by turning the page to the left or right. The upper part of the window displays the time corresponding to the current cursor position. The parameter area displays the parameter data at that time, and they will automatically change with the movement of the cursor.
- Select "SELECT WAVEFORM" to set waveform 1~waveform 4 in the pop-up waveform selection box, and set the waveforms as I, II, III, aVR, aVL, aVF, V, VI, V2, V3, V4, V5, V6, RESP, Pleth, IBPI, IBP2, CO2, IBP3, IBP4.
- Select "GAIN "to change the gain of ECG waveform.
- Select "TRAVELING SPEED": Under different wave speeds, the width of the waveform displayed in the window will change accordingly.
- Select the record icon to output the first three waveforms and parameter values through the recorder.
- Select " " and " " buttons on both sides of "EVENT "to switch to the corresponding event.

17.6 OxyCRG reviewing

Select " OxyCRG" in the "REVIEW" menu to enter the window shown in the figure below.



Events that can be reviewed include blood oxygen and respiratory events. When an event occurs, the monitor will store the values of related parameters at the time of occurrence and related waveforms of 240s before and after the time of occurrence, so that the user can review the event.

The waveform storage time is determined by the setting of the event storage time length.

- Select event type: Select the event type to be reviewed in the list of "TYPES" as required.

NOTE

- **The power failure of the monitor has no effect on the stored events**

After selecting an event, select "DETAILED INFORMATION" to enter the window shown in the figure below. The waveform area will display the waveform related to the event, and the parameter area will display the parameter values related to the moment the event occurs.

- Swipe left and right in the waveform display area to move the waveform.
- Select "◀" and "▶" buttons on both sides of "EVENT" to switch to the corresponding event.
- Select SETTING to enter the interface of respiratory oxygenation setting to set the trend-1, trend-2 and compressed c waveform.
- Select the record icon to record the currently selected respiratory oxygenation event.
- Select the print icon to print the currently selected respiratory oxygenation event.
- Select "EVENTS LIST" to display the respiratory oxygenation events that have occurred in a list.

17.7 OxyCRG reviewing

Select "BLOOD PRESSURE" in the "REVIEW" menu to enter the window in the figure below.

Review					
Tabular Trend		Events	OxyCRG	Full Disclosure	NIBP Review
NIBP Review Total times:1					
ID	Time	Systolic (mmHg)	Diastolic (mmHg)	Mean (mmHg)	PR bpm
1	2020-09-18 13:51:28	120	80	93	80

Print

In the blood pressure review interface, all blood pressure measurement data are displayed, and the serial number, measurement time, systolic blood pressure, diastolic blood pressure, mean pressure and pulse rate are displayed in reverse order of measurement time.

- Select the print icon to print the blood pressure review list.

Chapter 18 Calculation

18.1 Introduction

The monitor provides a calculation function. The calculated value is not directly measured patient data, but the result calculated by the monitor according to the appropriate data provided by you.

The following calculations can be performed on this monitor:

- Drug calculation
- Oxygenation calculation
- Ventilation calculation
- Hemodynamic calculation
- Kidney function calculation

To perform a certain calculation, please select "MAIN MENU"- "CALCULATION", or select the "CALCULATION" hot key

NOTE

- The calculation is independent of other functions of the monitor, and the object of calculation may not be the patient monitored by the monitor. The calculation operation will not affect the patient being monitored.



WARNING

- The correctness of the input parameters and the suitability of the calculation results should be carefully verified during calculation. The company is not responsible for all consequences caused by input and operation errors.

18.2 Drug Calculation

18.2.1 Calculation steps

1. Select "MAIN MENU"- "CALCULATION" "DRUG CALCULATION", or select "CALCULATION" "hot key"- "DRUG CALCULATION".
2. Select "PATIENT TYPE" and "DRUG NAME". In the drop-down list on the right side of "DRUG NAME", you can select the desired drug from the following 15 drugs.

Among them, the names of drugs A, B, C, D, and E can be defined by the user.

- Drugs A, B, C, D, E
- Aminophylline
- Dobutamine
- Dopamine
- Adrenaline
- Heparin
- Isoproterenol

- Lidocaine
 - Sodium Nitroprusside
 - Nitroglycerin
 - Oxytocin
3. After completing the previous operations, the system will automatically give a set of default values, but these data cannot be used as calculation results. Instead, the known and correct parameter values must be entered according to the doctor's instructions.
 4. Enter the patient's weight.
 5. Enter the correct parameter value.
 6. Confirm the correctness of the calculation results.

18.2.2 Calculation unit

Each drug has its fixed unit or unit series. In the same unit series, the unit series will be automatically adjusted according to the input value.

The rules for expressing the units are:

- Drugs A, B, C, aminophylline, dobutamine, dopamine, epinephrine, isoproterenol, lidocaine, sodium nitroprusside and nitroglycerin, using series units: g (gram), mg (Milligrams), mcg (micrograms).
- Drug D, heparin and oxytocin, use series of units: Unit (unit), KU (thousand units), MU (million units).
- Drug E unit of use: mEq (mill equivalents).

When customizing a certain medicine, the operator should choose medicine A, B, C, D or E according to the unit series.

NOTE

- For neonatal patients, "DRIP RATE "and "VOLUME PER DROP "are disabled.

18.2.3 Titration table

After completing the drug calculation, select "TITRATION TABLE >>" in the "DRUG CALCULATION" window to open the titration table.

In the titration table, you can change:

- "BENCHMARK ITEM "
- "STEP LENGTH"
- "DOSE TYPE"

After changing the above options, the data in the trend table will change accordingly. You can also;

Choose “” or “” to observe more data.

Select the record icon to output the data displayed in the current window through the recorder.

18.2.4 Drug calculation formula

Abbreviation	Unit	Formula
Conc.	G/ml unit/ml or mEq/ml	Amount / Volume
Dose	Dose/hr, Dose/kg/min	Rate x Conc
Volume	MI	Rate x Duration
Amount	G, unit, mEq	Rate x Duration
Duration	H	Amount/ Dose
Drip Rate	Gtt/min	INF Rate x Drop Size/60

18.3 Oxygenation Calculation

18.3.1 Calculation steps

1. Select "MAIN MENU"- "CALCULATION"- "OXYGENATION CALCULATION", or select "CALCULATION" "hot key- "OXYGENATION CALCULATION".
2. Enter the correct values for each parameter.
3. Select the "CALCULATION" button to calculate the value of each output parameter.
 - ◆ For output values beyond the reasonable range, the background is displayed in yellow. At this time, select "VALUE RANGE", and its reasonable range will be displayed.
 - ◆ "---" indicates invalid value.

In the oxygenation calculation window, you can:

- Select "PRESSURE UNIT", "HB UNIT "and "UNIT", the values of the relevant parameters will be automatically converted and refreshed.
In the interface of oxygenation calculation review, select "RECORD", the current calculation result will be output by the recorder.
Select "CALCULATION REVIEW "to review the results of previous calculation.

18.3.2 Input parameter

Abbreviation	Unit	English name
C.O.	L/min	Cardiac output
FiO ₂	%	Percentage fraction of inspired oxygen
PaO ₂	MmHg	Partial pressure of oxygen in the arteries
PaCO ₂	MmHg	Partial pressure of carbon dioxide in the arteries
SaO ₂	%	Arterial oxygen saturation

PvO ₂	MmHg	Partial pressure of oxygen in venous blood
SvO ₂	%	Venous oxygen saturation
Hb	G/L	Hemoglobin
CaO ₂	ML/L	Arterial oxygen content
CvO ₂	ML/L	Venous oxygen content
VO ₂	ML/min	Oxygen consumption
RQ	None	Respiratory quotient
ATMP	MmHg	Atmospheric pressure
H	Cm	Height
W	Kg	Weight

18.3.3 Output parameter and formula

Abbreviation	Unit	English name	Formula
BSA	M ²	Body surface area	Wt ^{0.425} x Ht ^{0.725} x 0.007184
VO ₂ calc	ML/min	Oxygen consumption	C(a-v) O ₂ x C.O.
C(a-v) O ₂	ML/L	Arteriovenous oxygen content difference	CaO ₂ - CvO ₂
O ₂ ER	%	Oxygen extraction ratio	100 x C(a-v) O ₂ / CaO ₂
DO ₂	ML/min	Oxygen transport	C.O. x CaO ₂
PAO ₂	MmHg	Partial pressure of oxygen int the alveoli	FiO ₂ / 100 x(ATMP-47) - PaCO ₂ x [FiO ₂ / 100 + (1 - Fi O ₂ / 100) RQ]
AaDO ₂	MmHg	Alveolar-arterial oxygen difference	PAO ₂ - PaO ₂
CcO ₂	ML/L	Capillary oxygen content	Hb x 1.34 + 0.031 x PAO ₂
Qs/Qt	%	Venous admixture	100 x [1.34 x Hb x (1 - SaO ₂ / 100) + 0.031 x (PAO ₂ - PaO ₂)] / [1.34 x Hb x (1 - SvO ₂ / 100) + 0.031 x (PA O ₂ - Pv O ₂)]
C.O.calc	L/min	Calculated cardiac ouput	VO ₂ / (CaO ₂ - CvO ₂)

18.4 Ventilation calculation

18.4.1 Calculation steps

1. Select "MAIN MENU" - "CALCULATION" "VENTILATION CALCULATION", or select "CALCULATION" hot key - "VENTILATION CALCULATION".
2. Enter the correct values for each parameter. If the monitor is connected to an anesthesia machine or ventilator, the values of the patient parameters that support the calculation are automatically loaded in the ventilation calculation window.
3. Select the "CALCULATION" button to calculate the value of each output parameter.
 - For output values beyond the reasonable range, the background is displayed in yellow. At this time, select "VALUE RANGE", and its reasonable range will be displayed
 - + "—" indicates invalid value.

In the ventilation calculation window, you can:

Select "UNIT", the values of the relevant parameters will be automatically converted and refreshed.

- In the interface of ventilation calculation review, select "RECORD", the current calculation result will be output through the recorder.
- Select "REVIEW" to review the results of previous calculations.

18.4.2 Input Parameter

Abbreviation	Unit	English name
FiO ₂	%	Percentage fraction of inspired oxygen
RR	Rpm	Respiration rate
PeCO ₂	MmHg	Partial pressure of mixed expiratory CO ₂
PaCO ₂	MmHg	Partial pressure of carbon dioxide in the arteries
PaO ₂	MmHg	Partial pressure of oxygen in the arteries
TV	ML	Tidal volume
RQ	None	Respiratory quotient
ATMP	MmHg	Atmospheric pressure

18.4.3 Output Parameter and Formula

Abbreviation	Unit	English name	Formula
PAO ₂	MmHg	Partial pressure of oxygen in the alveoli	(ATMP - 47) x FiO ₂ / 100 - PaCO ₂ x [FiO ₂ / 100 + (1 - FiO ₂ / 100) / RQ]
AaDO ₂	MmHg	Alveolar-arterial oxygen difference	PAO ₂ - PaO ₂
Pa/FiO ₂	MmHg	Oxygenation ratio	100 x PaO ₂ / FiO ₂

A/AO ₂	%	Arterial to alveolar oxygen ratio	$100 \times \text{PaO}_2 / \text{PAO}_2$
MV	L/min	Minute volume	$(\text{TV} \times \text{RR}) / 1000$
Vd	ml	Volume of physiological dead space	$\text{TV} \times (1 - \text{PeCO}_2 / \text{PaCO}_2)$
Vd/Vt	%	Physiologic dead in percent of tidal space volume	$100 \times \text{Vd/TV}$
VA	L/min	Alveolar volume	$(\text{TV} - \text{Vd}) \times \text{RR} / 1000$

18.5Hermodynamic calculation

18.5.1 Calculation steps

1. Select "MAIN MENU" - "CALCULATION"- "HEMODYNAMIC CALCULATION", or select" CALCULATION "hot key - "HEMODYNAMIC CALCULATION".
2. Enter the correct value for each parameter.
 - The default values for HR, Art Mean, PA Mean, and CVP are the current real-time measurements if they are calculated for a patient being monitored; If a C.O.measurement has just been performed, the default value for C.O. is the average of multiple C.O measurements selected; Height and weight are from the patient information entered. When the monitor is unable to provide these data, the display is blank and you will need to enter them manually.
 - If you are not calculating for a patient under supervision, you will need to confirm or modify all input values.
3. Select the "CALCULATION "button to calculate the value of each output parameter.
 - For output values beyond the reasonable range, the background is displayed in yellow. At this time, select "VALUE RANGE", and its reasonable range will be displayed
 - "---"indicates invalid value.

In the ventilation calculation window, you can:

In the interface review, select "RECORD", the current calculation result will be output by the recorder.

Select "REVIEW "to review the results of previous calculation.

18.5.2 Input Parameter

Abbreviation	Unit	English name
C.O.	L/min	Cardiac output

HR	Bpm	Heart rate
PAWP	MmHg	Pulmonary artery wedge pressure
Art Mean	MmHg	Artery mean pressure
PA Mean	MmHg	Pulmonary artery mean pressure
CVP	MmHg	Central venous pressure
EDV	M	End-diastolic volume
H	Cm	Height
W	Kg	Weight

18.5.3 Output parameter and formula

Abbreviation	Unit	English name	Formula
C.I.	L/min/m ²	Cardiac index	C.O./BSA
BSA	M ²	Body surface area	Wt ^{0.425} x Ht ^{0.725} x 0.007184
sv	Ml	Stroke volume	C.O. / HR x 1000
SI	Ml/ m ²	Stroke index	SV/BSA
SVR	DS/cm ⁵	Systemic vascular resistance	79.96 x (APMAP - CVP)/C.O.
SVRI	DS.m ² / cm ⁵	Systemic vascular resistance index	SVR x BSA
PVR	DS/cm ⁵	Pulmonary vascular resistance	79.96 x (PAMAP-PA WP) /C.O.
PVRI	DS.m ² / cm ⁵	Pulmonary vascular resistance index	PVR x BSA
LCW	Kg.m	Left cardiac work	0.0136 x APMAP x C.O.
LCWI	Kg.m/m ²	Left cardiac work index	LCW /BSA
LVSW	G.m	Left ventricular stroke work	0.0136 x APMAP x SV
LVSWI	G.m/m ²	Left ventricular stroke work index	LVSW /BSA
RCW	Kg.m	Right cardiac work	0.0136 x PAMAP x C.O.
RCWI	Kg.m/m ²	Right cardiac work index	RCW /BSA
RVSW	G.m	Right ventricular stroke	0.0136 x PAMAP x SV
RVS WI	G.m /m ²	Right ventricular stroke work index	RVSW / BSA
EF	%	Ejection fraction	100 x SV /EDV

18.6 Thermodynamic calculation

18.6.1 Calculation steps

1. Select "MAIN MENU"- "CALCULATION"- "KIDNEY FUNCTION CALCULATION", or select " CALCULATION "hot key- "KIDNEY FUNCTION CALCULATION".
2. Enter the correct values for each parameter.
3. Select the "CALCULATION "button to calculate the value of each output parameter.
 - ◆ For output values beyond the reasonable range, the background is displayed in yellow. At this time select "VALUE RANGE", and its reasonable range will be displayed
 - ◆ "---" indicates invalid value.

In the Kidney function calculation window, you can:

In the interface review, select "RECORD", the current calculation result will be output by the recorder.

 - Select "REVIEW "to review the results of previous calculations.

18.6.2 Input Parameter

Abbreviation	Unit	English name
URK	Mmol/L	Urine potassium
URNa	Mmol/L	Urinary sodium
Urine	ML/24h	Urine
Posm	MOsm/kgH ₂ O	Plasma osmolality
Uosm	MOsm/kgH ₂ O	Urine osmolality
SerNa	Mmol/L	Serum sodium
Cr	Umol/L	Creatinine
UCr	Umol/L	Urine creatinine
BUN	Mmol/L	Blood urea nitrogen
H	Cm	Height
W	Kg	Weight

18.6.3 Output Parameter and formula

Abbreviation	Unit	English name	Formula
URNaEx	Mmol/24h	Urine sodium excretion	Urine x URNa / 1000
URKEx	Mmol/24h	Urine potassium excretion	Urine x URK / 1000
Na/K	%	Sodium potassium ratio	100 x URNa / URK
CNa	ML/24h	Clearance of sodium	URNa x Urine / SerNa

Cler	ml/min	Creatinine clearance rate	$U_{Cr} \times Urine/Cr / (BSA/1.73) / 1440$
FENa	%	Fractional excretion of sodium	$100 \times (UR_{Na} \times Cr) / (SER_{Na} \times U_{Cr})$
Cosm	ml/min	Osmolar clearance	$U_{osm} \times Urine / Posm / 1440$
CH ₂ O	ml/h	Free water clearance	$Urine \times (1 - U_{osm}/Posm) / 24$
U/P osm	None	Urine to plasma osmolality ratio	$U_{osm}/Posm$
BUN/Cr	None	Blood urea nitrogen creatinine ratio	$1000 \times BUN/Cr$
U/Cr	None	Urine-serum creatinine ratio	U_{Cr}/Cr

*: BUN/Cr is the ratio in the mol unit system.

18.7 Calculation review

For oxygenation, ventilation, hemodynamics and kidney function calculations, you can review historical calculation results. The review windows for various calculations are basically the same.

Taking hemodynamic calculation as an example, select "REVIEW" in the "HEMODYNAMIC CALCULATION" window to enter the review window.

In the review window:

- By selecting " " and " " buttons, you can observe more calculation results.
- Output values that are out of the reasonable range are shown in yellow in the background. The "UNIT" column shows the units of each parameter. If there are some parameters in a column over a reasonable range, then select the column, and then select "VALUE RANGE", "UNIT" column will be changed to show the corresponding reasonable range of these parameters.
- After selecting a column, select "ORIGINAL CALCULATION", you can return to the "HEMODYNAMIC CALCULATION" window. You can perform the next calculation based on the calculation result, or record the calculation result.

Chapter 19 Recording

19.1 Recorder

The monitor uses a thermal array recorder, supports a variety of recording types, and can output patient information, measurement data, review data and contains up to 3 waveforms.

19.2 Recording type

According to the triggered method, the records can be divided into:

1. Real-time recording starts manually.
2. The recorder automatically starts timing recording according to the set interval.
3. Alarm record triggered by parameter overrun or arrhythmia.
4. Manually activated records related to a specific function.

19.3 Recording start & stop

You can manually start recording in the following ways:

Select the "RECORD" button on the current menu or window to start the recording related to specific function.

In the following situations, the recorder will automatically start recording:

- If the timing recording function is started, the recorder will automatically start recording according to the set interval.
- When the Alarm "ALARM SWITCH" and "ALARM RECORDS" of a parameter are both set to "ON", once the parameter generates an alarm, it will trigger the monitor to start an alarm record.

During the recording process, you can manually stop recording in the following ways:

Select the "RECORD" button.

Select "CLEAR RECORDS" in "MAIN MENU" - "RECORDS".

In the following situations, the recorder will automatically stop recording:

- The recording task is completed.
- The recorder is out of paper.
- A technical failure occurred that caused the recorder do not work properly.

The record report has the following completion marks when it is printed:

- Records that ended automatically: Print two columns of "*" at the end of the report.

- Manual termination or other abnormal termination records: Print a column of "*" at the end of the report.

19.4 Setting the Recorder

19.4.1 Open the setting menu

Select "RECORD SETTING" in "MAIN MENU"- "RECORDS" to open the "RECORD SETTING" menu.

19.4.2 Select record waveform

The recorder can output at most three waveforms at a time. In the "RECORD SETTING" menu, you can select "RECORD WAVEFORM 1", "RECORD WAVEFORM 2" and "RECORD WAVEFORM 3", and then select the label of waveform in the pop-up list. If "OFF" is selected, the output of this waveform will be turned off. These settings are applicable to real-time recording and timing recording.

19.4.3 Setting real time record

When you start a real-time recording, the length of the recording depends on your settings on the monitor.

1. Open the "RECORD SETTING" menu.
2. Set the "REAL-TIME RECORDING TIME" to:
 - ◆ "8 s": Record the waveform of 4 seconds before and after the current time
 - ◆ "CONTINUOUS": Record the waveform after the current moment until the user stops recording.

19.4.4 Setting timing record

You can set a certain time interval, and the recorder will automatically start recording according to the set time interval. The length of each recording is 8 seconds.

1. Open the "RECORD SETTING" menu.
2. Set "TIMING RECORD INTERVAL".
3. After the setting is completed, the recorder starts each recording according to the set interval.

19.4.5 Setting recording speed

1. Open the "RECORD SETTING" menu.
2. Set "RECORD OUTPUT SPEED" to "25 mm/s" or "50 mm/s".
This setting applies to all recording tasks that contain waveforms.

19.4.6 Setting waveform overlay record

You can turn on or off IBP waveform overlay recording.

1. Open the "RECORD SETTING" menu.
2. Set "IBP OVERLAY" as:
 - ◆ "ON": If there are two or more IBP waveforms in the selected waveform to be recorded, the IBP waveform will be overlaid and recorded.
 - ◆ "OFF": IBP waveform is recorded normally.

19.4.7 Clear recording task

1. Open "MAIN MENU"- "RECORD".
2. Select "CLEAR RECORD " to clear all the records waiting to be output, and stop the current recording task.

19.5 Inserting paper

1. Pull out the buckle above the recorder door to open the recorder door.
2. Load the recording paper into the paper cavity in the direction shown in the figure below, with the paper head outside the paper outlet.
3. Close the recorder door.
4. Check the position of the recording paper to ensure that the recording paper is aligned with the paper outlet.

CAUTION

- The thermal recording paper meeting the requirements must be used, otherwise it may lead to failure of recording, poor recording quality or damage of thermal printing head.
- During the output process of the recorder, do not pull the recording paper outwards, otherwise the recorder may damaged.
- Do not keep the recording door open unless the paper is changed or the fault is removed.

19.6 Removing paper jam

When the recorder functions or sounds improperly, open the recorder door to check whether paper jam exists, if yes, remove it according to following steps;

1. Open the recorder door.
2. Take out the recording paper and cut off the wrinkled part.
3. Re-install the recorder paper and close recorder door.

19.7 Clean recorder

After the recorder is used for a long time, the paper scraps and impurities will accumulate on the print head, which will affect the quality of the record and the life of the print head and roller. Please clean as follows:

1. Before cleaning, take measures to prevent static electricity from damaging the recorder, such as wearing a disposable anti-static bracelet.
2. Open the door of the recorder and remove the recording paper to avoid obstructing cleaning.
3. Use a cotton ball to moisten an appropriate amount of alcohol, and then gently wipe the surface of the thermal part of the print head.
4. After the alcohol is completely dried, re-install the recording paper and close the recorder door.

CAUTION

- Do not use anything that will damage the thermal components, such as sandpaper.
 - Do not squeeze
-

Chapter 20 Other Function

20.1 Privacy mode

The privacy mode can only be activated when the patient is also monitored on the central monitoring system.

To activate privacy mode:

- Select "PRIVACY MODE" hot key or select "MAIN MENU"- "INTERFACE" -"PRIVACY MODE".

When the privacy mode is activated, the monitor will behave as follows:

- The screen is black, and it prompts "MONITORING, PLEASE PRESS ANY KEY TO EXIT THE PRIVACY MODE".
- The monitoring of the patient continues, and the storage of the patient data continues, but the patient data is only visible on the central monitoring system.
- The alarm can continue to be triggered. But the alarm sound and light are shielded at the monitor end.
- All system sounds of the monitor are shielded, including heartbeat sounds, pulse sounds, and various prompt sounds.



WARNING

- **In the privacy mode, all alarm sounds and lights at the monitor end are shielded, and the alarm sound is only sent out at the central station.**

To exit privacy mode:

- Press any key to exit the privacy mode.

In the following cases, the monitor will automatically exit the privacy mode:

- The monitor disconnects from the central station.
- A low battery alarm and a prompt to shut down appears.

20.2 Night mode

Night mode can be used when you want to avoid the monitor from disturbing the patient.

To start night mode:

1. Select "NIGHT MODE" hot key or select "MAIN MENU"- "INTERFACE"- "NIGHT MODE".
2. In the pop-up menu, set the screen brightness, alarm volume, heartbeat volume, key volume, NIBP completion tone, or select whether to stop the current NIBP measurement.
When "STOP NIBP MEASUREMENT" is selected, all NIBP measurements will be stopped after entering night mode.
3. Then select the "ENTER NIGHT MODE" button.

To exit night mode:

-
1. Select "NIGHT MODE" hot key or select "MAIN MENU"- "INTERFACE"- "NIGHT MODE".
 2. Select "OK" in the pop-up dialog box.
-

**WARNING**

- Before entering night mode, please confirm the settings of screen brightness, alarm volume, heartbeat volume, and key volume. If the setting value is small, please be aware of potential risks.
-

20.3 Wireless Network

The monitor is equipped with wireless network card, and wireless network is established through AP. The engineers or personnel designated by our company will be responsible for the installation and setup of wireless network for you, and conduct corresponding performance test.

The radio equipment used in this monitor complies with the main requirements of Directive 1999/5/EC (radio equipment and communication terminal equipment indication) and other provisions.

NOTE

- The design, installation, adjustment and maintenance of wireless network layout must be carried out by the maintenance personnel authorized by our company.
 - The existence of obstacles (such as load-bearing wall) will affect data transmission and even lead to network disconnection.
 - The central monitoring system can connect up to 64 monitors through wireless network.
-

Chapter 21 Battery

21.1 Introduction

The monitor can configure the rechargeable battery (lithium battery), which can ensure that the equipment can be used normally in the condition of power failure. The battery can be charged once connecting to the AC, no matter whether the equipment is powered on. Since we do not provide external charging equipment, the battery can only be charged in the monitor. When sudden power interruption appears, the system will automatically use the battery to supply power to the monitor without interruption of monitoring work.

The battery icon on the screen indicates the status of the battery:



Powered by battery, the solid part represents the battery power



Charging, the dynamic bar is green and full after fully charged



The battery power is too low, which indicates that the battery needs to be charged immediately.



When the battery is used up or battery fault occurs, it will automatically shut down after several minutes.

Working by the battery can only maintain a period of time. Too low voltage will trigger technical alarm "Low battery", then the monitor should be connected to AC power, otherwise it will shut down after the first alarm (about 10 minutes).

NOTE

- The design, installation, adjustment and maintenance of wireless network layout must be carried out by the maintenance personnel authorized by our company.



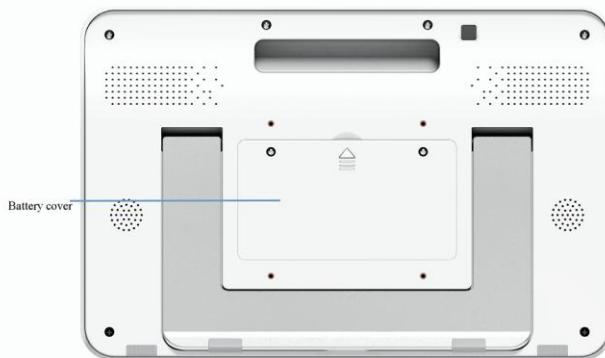
WARNING

- Don't take out the battery during monitoring.
- Only the battery specified by the manufacturer can be used.
- Keep the battery out of children's reaching.
- Don't destroy the battery: Don't chisel the metal into the battery, hammer or knock the battery, or use other methods to destroy the battery, to avoid the battery heating, smoking, deformation or burning, even producing risks.
- The battery can only be used in the monitor, any maintenance or replacement of the battery must be carried out by our trained and authorized service engineers.
- If the electrolyte exudes and enters your eye, please don't rub your eyes, use clean water to rinse immediately and go to the doctor.
- If there is the sign of battery damage or leakage, please replace it immediately. Don't use the faulted battery.

21.2 Battery Installation

To install or replace the battery:

1. Turn off the power supply of the monitor and disconnect the power cord and other connecting wires.
2. Lay down the monitor with the front panel down.
3. Open the battery cover: Unscrew two screws fixed the battery cover with a tool.



4. Take out the battery, then connect the new battery to the battery extension cable, and then put it into the battery box.
5. Install the battery cover and put the monitor in the right position.

21.3 Check for battery performance

The battery performance may decrease with the increasing of use time. Please refer to the following steps to check the battery performance.

1. Disconnect the connection between the device and the patient to stop all monitoring and measurement.
2. Connect the device to AC to continuously charge the battery for above 5 hours.
3. Disconnect the AC, use the battery to supply power for the device till shutdown.
4. Battery-powered time reflects the battery performance.

If the battery-powered time is obviously lower than the time claimed in the specification, please replace the battery or contact the maintenance personnel.

NOTE

- In order to protect the environment, please recycle the scrap battery as the regulations.

- The power supply time of the battery depends on the device configuration and operation. For example, frequent NIBP measurement will shorten the power supply time of the battery.
- The battery should be maintained periodically to prolong its service life. If the device is not used for a long time without taking out the battery, please charge it once per 3 months, to avoid shortening the battery life.

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Chapter 22 Maintenance and Cleaning

Only use the material and method listed in this chapter to clean or maintain the device. For damage or accidents caused by the use of other materials or methods, we do not provide any guarantee. Our company is not responsible for the effectiveness of the listed chemicals or methods as a means of infection control. Consult the hospital's infection prevention department or epidemiologists about ways to control infection.

Maintenance of the device and its parts should not be performed when the device is in use.

22.1 Introduction

Keep the device and accessories out of dust. After cleaning, please check the device carefully. If any signs of aging or damage are found, please discontinue use immediately. In order to prevent damage, please obey the following rules:

- Please dilute the detergent and disinfectant according to the manufacturer's instructions, or adopt the lower concentration as soon as possible.
- Don't immerse the device into the liquid.
- Don't pour the liquid into the device or accessories.
- Don't allow liquid to enter into the enclosures.
- Don't use abrasion material (such as steel wool or silver polishing agent) and any strong solvent (such as acetone or the detergent contained acetone).



WARNING

- Before cleaning the device, it is necessary to turn off the power supply and disconnect the power cord from the socket.
 - Only use the detergents and disinfectants recommended in this manual. The use of other cleaners and disinfectants can cause damage or safety hazards.
 - Detergent should not be mixed, otherwise dangerous gas will be produced.
 - This chapter only introduces the cleaning method of reusable accessories. Disposable accessories cannot be used again after cleaning and disinfection to avoid cross infection.
 - In order to protect the environment, disposable accessories must be recycled or properly treated.
 - After cleaning, if the sensor cable is damaged or aged, it should be replaced with a new cable.
-

22.2 Cleaning

The device should be kept clean. The outer surface should be cleaned periodically, in the area of seriously polluted or greater sand wind, cleaning frequency should be increased. Regular cleaning of the monitor accessories is also required before cleaning, please consult or understand the regulations about device cleaning in advance.

Selectable detergents:

- Diluted sodium hypochlorite (Bleaching powder for washing)
- Hydrogen Peroxide (3 %)
- Alcohol (70 %)
- Isopropanol (70 %)

Cleaning for host:

Clean the monitor surface according to the following steps:

1. Turn off the power and unplug the power cord.
2. Use the soft cloth adsorb proper detergent to completely wipe the external surface (including the LED) of the device until that there is no obvious dirt.
3. After cleaning, please use the new cloth or paper towel adsorb proper tap-water to wipe the residual detergent until that there is no obvious dirt.
4. Place the device in ventilation and shady environment for air drying.

22.3 Cleaning for the reusable ECG lead cable and electrode

1. Cleaning for the ECG lead cable and electrode

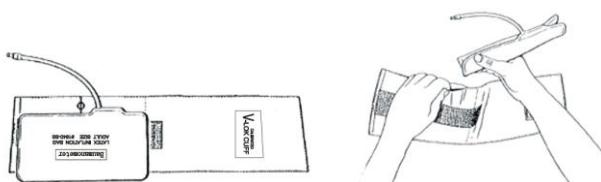
- a. Use the soft cloth adsorbed proper detergent to completely wipe the lead cable surface until that there is no obvious dirt.
- b. After cleaning, please use the new cloth or paper towel adsorbed proper tap-water to wipe the residual detergent until that there is no obvious dirt.
- c. Use a dry soft to wipe the residual water.
- d. Place the lead cable assembly in ventilation and shady environment for air drying.

NOTE

- Please do not use high pressure, radiation or steam to disinfect the lead cable.
- Please do not immerse the lead cable into the liquid directly.
- In order to avoid long-term damage to the cable, it is recommended to disinfect the product only if necessary according to the hospital regulations you follow.
- Do not clean and reuse disposable electrodes.

2. Cleaning for NIBP cuff

- a. Remove the cuff from the connector and take out the gasbag from the opening of the long side of the cuff covering;
- b. Soak the clean medical soft gauze pad or other soft cleaning tools in clean water or neutral soapy water, and then wipe the gasbag and hose after squeezing out the excess water from the soaked gauze.
- c. Wash the cuff in clean neutral soapy water.
- d. After the cleaned cuff and the gasbag are fully dried, roll up the gasbag and install it from the opening of the long side of the cuff covering (as shown in the figure below); Shake the whole cuff until the gasbag is in place and then thread the hose through the small hole lining. It can be put into use again after installation.



NOTE

- Excessive and repeated cleaning of the gasbag may damage the airbag. Do not clean the airbag unless necessary.
- The gasbag and the cuff covering shall not be dried at high temperature.
- For higher disinfection level, please use disposable cuff.
- Disposable cuff can only be used for one patient.
- Water and detergent must not enter the connecting parts between the cuff and the monitor.

3. Cleaning for SPO₂ sensor

- a. Use a soft cloth adsorbed proper mild detergent solution to wipe the surface of sensor, including the finger pad and sensor cable.
- b. Use the soft cloth adsorbed proper tap-water to wipe the residual detergent until that there is no obvious dirt.
- c. Use a dry cloth to wipe the surface of the sensor and the cable, and the sensor interior should be naturally dried.

NOTE

- Do not use radiation-X-ray, steam or ethylene oxide to disinfect the sensor.
- Do not immerse the sensor in liquid directly.

- In order to avoid long-term damage to the sensor, it is recommended to disinfect the product only if necessary according to the hospital regulations you follow.

4. Cleaning for TEMP sensor

- a. Hold the tip of the temperature probe with one hand, and wipe the surface of TEMP probe downward with a wet, lint free cloth with the other hand.
- b. Use a dry cloth to wipe the surface of TEMP probe.
- c. Check TEMP probe. Do not reuse if there is any sign of deterioration or damage.

NOTE

- For disposable TEMP sensors, repeated disinfection and reuse are not allowed.
- In order to avoid long-term damage to the sensor, it is recommended to disinfect the product only if necessary according to the hospital regulations you follow.
- The TEMP sensor can only withstand the temperature of 80 °C ~ 100 °C for a short time, so it should not be heated more than 100 °C.

5. Carbon dioxide

- a. The outer surface of the CO₂ module can be cleaned and disinfected with cleaning solution or neutral soapy water. Then use a clean soft cloth dipped in water to wipe, and can be used after drying.
- b. The reusable airway adapter can be cleaned with neutral soapy water. The airway adapter can be cleaned with sterile water and then dried.
- c. Before reusing the airway adapter, make sure that its window is dry and residue free and is not damaged during processing, cleaning or disinfection.

NOTE

- The side-stream module adopts disposable sampling tube, which cannot be disinfected again.
- If the mainstream module uses disposable adapter, it cannot be disinfected again.
- When the sampling system of the side-stream module is blocked, check whether the sampling tubes are entangled together firstly.

22.4 Disinfection

To avoid extended damage to the device, disinfection is only recommended when stipulated as necessary in the Hospital Maintenance Schedule.

The device should be cleaned firstly before disinfection.

Disinfectant recommended: alcohol (70 %), isopropanol (70 %).

If alcohol or isopropanol is used in both cleaning and disinfection, please cleaning cloth for disinfection.

CAUTION

- Do not use gas (EtO) or formaldehyde for disinfection.
-

Chapter 23 Maintenance

WARNING

- The hospital or medical institution using the device should establish a perfect maintenance plan, otherwise it may result in device failure and unpredictable consequences, even endanger personal safety.
- All safety inspections or maintenance works to the components to be disassembled should be carried out by professional maintenance personnel, otherwise it may result in device failure, even endanger personal safety.
- If any problem has been found, please contact the maintenance personnel or our company.

23.1 Check

The monitor should be completely checked before using, or after continuous use of 6 to 12 months, maintenance or upgrading, to ensure normal operation and working. The items to be checked should include:

- Environment and power meet the requirements.
- No abrasion and good insulation performance for the power cord.
- No mechanical damage for the device and accessories.
- The accessories specified are used.
- Alarm functions are normal.
- The recorder works normally, the recording paper conforms to specified requirements.
- Battery performance.
- Each monitoring function is in good working state.
- Ground impedance and leakage current conform requirements.

If any signs of damage can be found, please don't use the monitor to perform any monitoring on the patient. And contact the medical engineer of the hospital or the maintenance engineer of the company immediately.

23.2 Troubleshooting

▪ Power failure

Always install the battery when using the monitor. Otherwise, once the mains power is disconnected, all trend data will be lost. When the battery is installed, the device is supplied power by the battery after disconnecting from the mains. The battery power supply only sustains a period of time. When the mains power is restored, it will be automatically switched to the mains power. A low battery voltage will trigger a high-tech alarm "Low battery", and it will shut down after the first alarm (about 10 minutes).

▪ Troubleshooting

Other problems related to ECG Measurement

Symptoms	Possible reasons and solutions
----------	--------------------------------

Noisy ECG signals or no QRS waveform is checked	<ul style="list-style-type: none"> ▪ Make sure that the patient does not tremble. Incorrect ECG filter ▪ The electrode is poor in quality or placed in a wrong position Check electrodes, cables and their placement. Refer to "ECG Monitoring" for details. ▪ Replace a lead. Remove the ECG cable from the interface and insert it again
Thick ECG baseline.	<p>ECG cable is looped. Other power cables are close to ECG lead cables. Inappropriate power frequency.</p>

Other problem related to RESP measurement

Symptoms	Possible reasons and solutions
Failure in RESP measurement.	<ul style="list-style-type: none"> ▪ Check electrode quality and placement. ▪ Other electrical equipment may interfere the measurement.

Other problem related to NIBP measurement

Symptoms	Possible reasons and solutions
NIBP measurement cannot be performed	<ul style="list-style-type: none"> ▪ Check where the cuff is bent, stretched, squeezed, or loose. ▪ Use a cuff in proper size.

Other problems related to TEMP measurement

Symptoms	Possible reasons and solutions
Failure in TEMP measurement.	<ul style="list-style-type: none"> ▪ Check whether an appropriate probe is used. ▪ Try the other one.

Other problems related to SpO₂ measurement

Symptoms	Possible reasons and solutions
The signal is weak.	<ul style="list-style-type: none"> ▪ Check the probe and its placement. ▪ Make sure the patient is not trembling.

Other problems related to IBP measurement

Symptoms	Possible reasons and solutions
BP calibration error	If the IBP waveform channel displays "calibration error", please re-enter the IBP setting menu and press the zero key. If the "calibration error" is still displayed, it indicates that there is something wrong with the sensor, and it is recommended to replace the sensor.
The IBP display value is quite different from the expected value.	If the IBP display value is significantly different from the expected value, reset the sensor to zero, and then perform IBP measurement.

Other problems related to CO₂ measurement

Symptoms	Possible reasons and solutions
CO ₂ respiratory asphyxia	The patient is not breathing, or the respiratory signal is too weak to be analyzed by the system. Check the patient's condition, accessories and gas connections.
Gas tube is blocked (CO ₂)	Check whether the accessory gas tube is blocked or entangled.
Gas tube is not blocked (CO ₂)	Check whether the gas tube is connected well.
No measured data (CO ₂)	Check whether the accessories are connected correctly and restart the device. If the fault still exists, please contact maintenance personnel.

Other problems related to battery

Symptoms	Possible reasons and solutions
Battery working time significantly shortens.	Maintain the battery according to the descriptions in the manual

Other conditions

Other possible conditions and reasons are listed in the table. Other operation problems

Symptoms	Possible reasons and solutions
The device cannot print.	The battery power is low and the hosts not connected to AC.
The measurement value does not display.	Check if you have selected the required parameters for the waveform or digital area.
The device cannot turn on.	Check whether the power cord is connected correctly. Check the fuses and replace them if necessary.
The screen stopped in LOGO interface.	Replace the mainboard, or contact the engineer to re-brush the mainboard program.

23.3 Maintenance plan

In addition to visual inspection, power on test, battery inspection and recorder inspection, the following tasks can only be performed by the professional staff authorized by our company.

Please contact the maintenance personnel when you need the following maintenance. Before test or maintenance, the device must be cleaned and disinfected.

Check / Maintenance Item	Frequency
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ECG test	Module calibration	1. When the user suspects that the measurement value is inaccurate.
Performance test		
Resp performance test		
SpO ₂ test		2. After maintenance or replacement of relevant modules.
NIBP test	Pressure calibration	3. At least once per two years.
Air leakage detection		
Temp test		
IBP test	Performance test	Note: NIBP and CO ₂ modules should be at least once a year.
	Pressure calibration	
Mainstream CO₂ test		
Side-stream CO₂ test	Performance test	1. After the power module is repaired or replaced
	Module calibration	2. Or after the monitor falls
Electrical safety test		
Electrical safety test	Enclosure leakage current test	3. At least once per two years or on demand
	Earth leakage current	
	Patient leakage current	
	Patient auxiliary current	

23.4 NIBP pressure calibration

NIBP pressure calibration should be performed once per two years at least or once when you thought that the reading is inaccurate.

Prepared materials:

- ◆ Standard manometer
- ◆ Metal container (500 ml)
- ◆ Spherical air pump
- ◆ Airway tube
- ◆ T-shape connector

Procedures of NIBP pressure calibration:

- I. Connect the monitor, standard manometer, spherical air pump and metal container as shown in the diagram below.

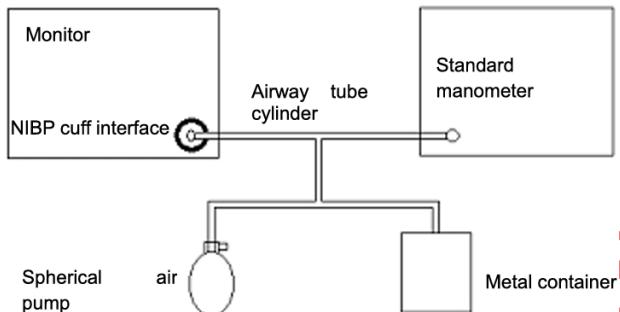


Diagram of NIBP Calibration

2. The manometer should read zero before inflation. If it is not zero, open the valve of the spherical air pump to make the whole gas path open to the atmosphere, and then close the valve after the reading of the standard manometer is zero.
3. Select "MAIN MENU"- "MAINTANENCE"- "NIBP CALIBRATION".
4. Check the readings of standard manometer and monitor, both of which should display pressure value of 0mmHg.
5. The rigid container was inflated with a spherical air pump to make its internal pressure reach 50 mmHg, then stop filling and wait for 10s to stabilize the measured value.
6. Check the readings of standard manometer and monitor, and the difference between them should be within 3 mmHg. If the difference is greater than 3mmHg, please contact the maintenance personnel.
7. Use a spherical air pump to inflate the rigid container to 200 mmHg, stop the inflation and wait 1 Os for the measured value to stabilize. Repeat step 6.

23.5 NIBP pneumatic leakage

It is mainly used to check whether the airtight condition of the air circuit is good. If the test passes, the system will not prompt any information. Otherwise, it will prompt corresponding information in NIBP information area. NIBP air leakage test should be performed once per two years at least or once when you thought that the reading is inaccurate.

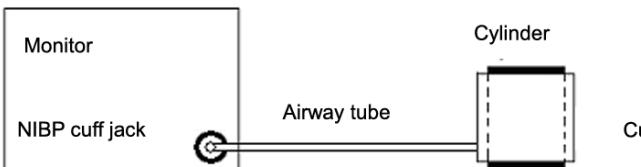
Prepared materials:

- ◆ Adult cuff: One
- ◆ Airway tube: One
- ◆ Cylinder: One

Procedures of the air leakage test:

1. Set "Patient type" to "Adult".

2. Connect the cuff with the NIBP cuff jack.
3. Wrap the cuff around the cylinder of an appropriate size, as shown in the figure below.



4. Select "PNEUMATIC" in NIBP menu, then the information "Pneumatic testing ..." will display in the NIBP parameter area.
5. The system will automatically deflate after about 25s, indicating that the leakage test has finished.
6. If no prompt information appears in NBP parameter area, it indicates that the airway is in good situation and no air leaks exist. However if the prompt information "NIBP PNEUMATIC LEAK" appears, it indicates that the airway may have air leaks. In this case, the user should check whether the connection is loose. After confirming proper connections, the user should re-perform the pneumatic test.

NOTE

- This pneumatic test other than being specified in the EN 1060-3 standard is to be used by the user to simply determine whether there are air leaks in the NIBP airway. If at the end of the test, the system prompts that the NIBP airway has air leaks, please contact the manufacturer for maintenance.

23.6 ECG Module Calibration

The ECG signal may be inaccurate due to hardware or software problems when you use the monitor. The main manifestation is that the amplitude of waveform becomes larger or smaller. In this case, you need to calibrate the ECG.

1. Select the ECG waveform area, and set "Surgery" to "Diagnostic".
2. Select "MAIN MENU" - "MAINTENANCE >>" - "ECG MODULE CALIBRATION".

A square wave signal will appear on the screen

3. After calibration, select "STOP ECG MODULE CALIBRATION".

If necessary, you can output square wave and scale through recorder, and then measure more accurate error. If the error exceeds 5%, please contact maintenance personnel.

23.7 User Maintenance

Select "MAIN MENU"- "MAINTENANCE"- "USER MAINTENANCE"- enter the password "70808".

23.8 Monitor Infomation

Select "MAIN MENU"- "MAINTENANCE" - "MONITOR". The monitor information is mainly to view the software and hardware version information, so as to facilitate the manufacturer to maintain and trace the monitor.

23.9 Software Version

Select "MAIN MENU" - "MAINTENANCE"- "SOFTWARE VERSION". You can view version information of the system software from the pop-up menu.

23.10 Manufacturer Maintenance

Select "MAIN MENU" - "MAINTENANCE"- "MANUFACTURE MAINTENANCE"- enter the password

23.10.1 Maximum lines supported by system

Set the number of lines of waveform or parameter displayed on the monitor. The setting range is 8-12, and users can set the number according to their needs.

23.10.2 Maximum lines supported by system

To set the on and off the module.

23.11 Demonstation

Enter into the status of the demonstration:

1. Select "MAIN MENU" --> "MAINTENANCE".
2. Select "DEMONSTRATION"--> enter the demonstration password "2088"--> select "OK".

To exit the status of the demonstration:

1. Select "MAIN MENU"-> "MAINTENANCE".
2. Select "Exit THE STATUS OF THE DEMONSTRATION".
3. The monitor will exit the status of the demonstration.



WARNING

- The demonstration function is mainly used to show the performance of the machine and to train users. In actual clinical use, the demonstration function should be prohibited to prevent medical staff from mistakenly thinking that the monitor is displaying the waveforms and parameters of the monitored patient, which will affect patient monitoring and delay diagnosis and treatment of the condition.

Chapter 24 Accessories



WARNING

- Use only the accessories specified in this chapter, as other accessories may damage the monitor or fail to meet the specifications stated in this manual.
- Disposable accessories can only be used once, repeated use may lead to performance degradation or cross infection.
- If you find any damage to the accessories packing or accessories, please do not use the accessories.

24.1 ECG Accessories

ECG electrodes

Accessory name	Qty	Description	Remark
ECG electrodes (adult)	1 packet	Disposable	Standard configuration
ECG electrodes (child)	1 packet		Optional configuration

ECG lead cable

Accessory name	Qty	Description	Remark
EGG lead cable (5-Lead, American Standard, button-type)	1 PC		Standard configuration
EGG lead cable (5-Lead, European standard, button-type)	1 PC		Optional configuration
ECG lead cable (5-Lead, American Standard, child, clip-type)	1 PC		Optional configuration
ECG lead cable (5-Lead, European Standard, child, clip-type)	1 PC	Repeatable	Optional configuration
ECG lead cable (3-Lead, American Standard, button-type)	1 PC		Optional configuration
EGG lead cable (3-Lead, European standard, button-type)	1 PC		Optional configuration
ECG lead cable (3-Lead, American Standard, child, clip-type)	1 PC		Optional configuration

ECG lead cable (3-Lead, European Standard, child, clip-type)	1 PC		Optional configuration
ECG lead cable (5-Lead, American Standard, Defibrillation, clip-type)	1 PC		Optional configuration
EGG lead cable (12-Lead, American Standard, button-type)	1 PC		Optional configuration

24.2 SPO₂ Accessories

Accessory name	Qty	Intended user	Description	Remark
SpO ₂ probe (integrated, adult, finger clip)	1 PC	Adult (>40 Kg)	Repeatable	Standard configuration
SpO ₂ probe (integrated, adult, finger clip)	1 PC	Adult (>40 Kg)		Optional configuration
SpO ₂ probe (integrated, children, finger clip)	1 PC	Children (10 ~ 40 Kg)		Optional configuration
SpO ₂ probe (integrated)	1 PC	Adult or children (>10 Kg)		Optional configuration
SpO ₂ probe extension line	1 PC	---		Optional configuration
SpO ₂ probe (split, children, finger clip)	1 PC	Children (10 ~ 40 Kg)		Optional configuration
SpO ₂ probe (split, adult, fingertip)	1 PC	Adult (>40 Kg)		Optional configuration
SpO ₂ probe (split)	1 PC	Adult or children (>10 Kg)		Optional configuration
SpO ₂ probe (split, adult, finger clip)	1 PC	Adult (>40 Kg)		Optional configuration

24.3 NIBP Accessories

Airway tube

Accessory name	Qty	Description	Remark
NIBP extension tube (direct-plug connector and fast connector (female))	1 PC	Repeatable	Standard configuration

Cuff

Accessory name	Qty	Description	Remark
Neonatal cuff, repeatable	1 PC	Limb perimenter (6-11 cm)	Optional configuration
Infants cuff, repeatable	1 PC	Limb perimenter (10-19 cm)	Optional configuration
Children cuff	1 PC	Limb perimenter (18-26 cm)	Optional configuration
Adult cuff, repeatable	1 PC	Limb perimenter (25-35 cm)	Standard configuration
Adult cuff, repeatable, large size	1 PC	Limb perimenter (33-47 cm)	Optional configuration
Leg cuff for adult, repeatable	1 PC	Limb perimenter (46-66 cm)	Optional configuration

24.4 TEMP Accessories

Accessory name	Qty	Description	Remark
temperature probe, body surface type	1 PC	Repeatable	Standard configuration
temperature probe, body cavity type	1 PC		Optional configuration

24.5 IBP Accessories

Accessory name	Qty	Description	Remark
IBP module	1 PC	Repeatable	Standard configuration
IBP sensor	1 PC	Disposable	Standard configuration

IBP cable	1 PC	Repeatable	Standard configuration
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24.6 CO₂ Accessories

Side-stream module

Accessory name	Qty	Description	Remark
EtCO ₂ module, CO ₂ -M01 main unit	1 PC	/	Standard configuration
Sampling tube (nasal, with filter and dry pipe)	10 PCS	Disposable	Optional configuration
Sampling tube (nasal, with filter)	10 PCS		Standard configuration
Sampling tube (intubate, with filter and dry pipe)	10 PCS		Optional configuration
Sampling tube (intubate, with filter)	10 PCS		Optional configuration

Mainstream module

Accessory name	Qty	Description	Remark
EtCO ₂ module, CO ₂ -M02 main unit	1 PC	/	Optional configuration
Airway adapter			
Adult / child airway adapter	1 PC	Disposable	Optional configuration
Infant / neonatal airway adapter	1 PC		Optional configuration

Appendix A Product Specification

A.1 Safety Specification

A.1.1 Product Classification

The monitor is classified as follows according to IEC60601-1:

Type of protection against	Class I equipment, internally powered and external power supply equipment
Degree of protection against	Type CF, defibrillation-proof applied part
Degree of protection ingress of	IPX2
Working mode	Continuous working
Anti-explosion classification	The device is unsuited for application in the environment containing combustible anesthetic gas mixed with air, oxygen or nitrous oxide.

A.1.2 Environmental Specification

If used or stored outside the specified temperature and humidity range, the device may not satisfy the performance specifications listed here.

Working environment	
Temperature	+5 °C ~+40 °C
Humidity	15 %~85 %
Atmospheric pressure	70 kPa~106 kPa
Storage environment	
Temperature	-20 °C ~+55 °C
Humidity	≤ 95 % (no coagulation)
Atmospheric pressure	50 kPa~ 106 kPa

A.1.3 Power Supply

External power supply	
Input voltage	100V-240V~
Frequency	50Hz/60Hz
Input power	≤ 150VA

Internal battery	
Battery type	Li-ion Battery
Battery voltage	7.4 VDC
Battery capacity	5000mAh
Supply time	At least 5 hours Working condition: using new fully-charged batteries at working environment of 25°C Configuration: continuous measurement for ECG and SpO ₂ , and auto NIBP measurements at an interval of 15 minutes
Charging time	about 5 hours for fully charged
Shutdown extended	At least 5min (since the first low power alarm)

A.1.4 Physical Specification

Component	Dimensions (Ixw> h)	Weight	Remark
Host	351 mm x 234 mm x 60 mm	About 2.lkg	Standard configuration (including battery), weight does not include recorder and accessories;

A.1.5 Hardware Specification

A.1.5.1 Display Specification

Host display	
Type	Color TFT display
Dimensions (diagonal)	14"
Resolution	1920 x 1080
Display information	Up to 10-channel waveform

A.1.5.2 Recorder

Recorder type	Thermal dot-matrix
Recording waveform	Less than 3-channel
Paper width	48mm
Paper length	20m

Paper speed	25 mm/s, 50 mm/s
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A.1.5.3 LED on host

Physiological alarm indicator	One alarm indicator (yellow / red)
Technical alarm indicator	One alarm indicator (yellow / red)
Power indikator	One (green)
Battery Indicator	One (orange and green)

A.1.5.4 Audio indicator

Speaker	The sound emitted includes but is not limited to alarm sound (45-85 dB), QRS sound and power on self-test sound. It supports PITCH TONE and multi-level volume function; The alarm sound meets the requirements of IEC 60601-1-8 standard.
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A.1.5.5 Interface

Power supply	One AC power interface
Internet interface	One standard RJ45 type interface
USB interface	Two standard USB 2.0 interfaces
Equipotential terminal	One

A.2 Data storage

Trend recall	Up to 120 hours of review
Alarm event recall	Review for 1000 alarm events of all parameters and 8 / 16/32-second of corresponding waveform.
NIBP measurement review	Review for the latest 1000 groups of NIBP date.
12-Lead ECG analysis results	The latest 1000 groups
Patient information	Store up to 50 patient information
Full disclosure waveform	At least 72 hours

A.3 Wireless network

Reach the specifications	IEEE 802.11b/g/n, compatible Wi-Fi
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A.4 Measurement specifications

If no special instructions are given in the following specifications, the adjustable alarm limit is the same as the measurement range of the signal.

A.4.1 ECG Specification

Meet the standard	IEC60601-2-27, EC13
Lead mode	3-lead: I, II, III 5-lead: I, II, III, aVR, aVL, aVF, V 12-lead: I, II, III, aVR, aVL, aVF, VI ~V6
Waveform	3-lead: 1-channel waveform 5-lead: 2-channel waveform 12-lead: 12-channel waveform
Lead standard	AHA (American standard), IEC (European standard)
Sensitivity	2.5 mm/mV (x0.25), 5 mm/mV (x0.5), 10 mm/mV (x1), 20 mm/mV (x2), 40mm/mV (x4)
Wave scan speed	625 mm/s, 12.5 mm/s, 25 mm/s, 50 mm/s
Frequency response (bandwidth)	Diagnosis: 0.05 Hz~75 Hz (+0.4 dB, -3 dB); 76 Hz~150Hz (+0.4 dB, -4.5 dB) Monitoring: 0.67 Hz~40 Hz (+0.4 dB, -3 dB) Surgery: 1Hz~20 Hz (+0.4 dB, -3 dB) ST mode: 0.05 Hz~40Hz (+0.4 dB, -3 dB)
CMRR	Monitoring: ≥ 100 dB Surgery: ≥ 100 dB Diagnosis: ≥ 90 dB ST mode: ≥ 100 dB
NOTCH	50 Hz/ 60 Hz (NOTCH filter can be turned on or off manually)
Electrode polarization voltage range	± 500 mV
Lead-off check	DC for active lead: ≤ 0.1 μ A (drive lead ≤ 1 μ A)
Baseline recovery time	After defibrillation: ≤ 5 s (under monitoring and surgery)
Calibration signal	1mV (peak to peak value), accuracy: ± 5 %
Pacing pulse	

Pulse display	The pacing detection channel of this machine is lead II.		
Pulse indicator	Pulse is marked if the requirements are met: Amplitude: $\pm 2 \text{ mV} \sim \pm 700 \text{ mV}$ Width: $0.1 \text{ ms} \sim -2 \text{ ms}$ Rise time $10 \mu\text{s} \sim 100 \mu\text{s}$		
Pulse rejection	Pulse is rejected if the requirements of YYI 079: Sect 4.1.4.1 and 4.1.4.3 are met: Amplitude: $\pm 2 \text{ mV} \sim \pm 700 \text{ mV}$ Width: $0.1 \text{ ms} \sim \sim 2 \text{ ms}$ Rise time: $10 \mu\text{s} \sim 100 \mu\text{s}$		
Minimum input slew rate	4 V/s RTI		
Alarm limit	Range (bpm)	Step (bpm)	
HR high limit	Adult: (Low limit+1) ~ 300 Pediatric and neonate: (Low limit+1) ~ 350	1	
HR low limit	15 \sim (high limit - 1)		
ST high limit	(Low limit+0.1) ~ 2.0	0.1	
ST low limit	-2.0 \sim (high limit - 0.1)		
HR			
Measurement limit	Adult: 15 bpm \sim 300 bpm Pediatric/ neonate: 15 bpm \sim 350 bpm		
Accuracy	$\pm 1\%$ or $\pm 1 \text{ bpm}$, whichever is greater.		
Resolution	1 bpm		
Maximum suppression ability for T wave	1.2mV		
HR mean	In the RR interval within the latest 6 seconds, take the average value after removing the maximum and minimum values. The heart rate displayed on the screen is refreshed in every second.		
Response time for heart rate meter to HR change	80 to 120 bpm: $< 8 \text{ s}$ 80 to 40 bpm: $< 8 \text{ s}$		
Accuracy of heart rate meter and	After stable phase (20 s), the HR values are: Bigeminy ventricular: 80 bpm $\pm 1 \text{ bpm}$		

response to irregular rhythm	Bigeminy ventricular alternative slow: 60 bpm ± 1 bpm Bigeminy ventricular alternative rapid: 120 bpm ± 1 bpm Systoles bidirectional: 90 bpm ± 1 bpm	
Time to alarm for tachycardia		
Tachycardia ventricular: amplitude=1mV(p-v), heart rate=206bpm	Gain 1.0: 8s	
	Gain 0.5: 8s	
	Gain 2.0: 8s	
Tachycardia ventricular: amplitude=2mV(p-v), heart rate=206bpm	Gain 1.0: 8s	
	Gain 0.5: 8s	
	Gain 2.0: 8s	
Arrhythmia types	Asystole VFIB / VTAC PVC COUPLET VT>2 Supraventricular tachycardia Bradycardia Bigeminy Trigeminy R ONT Missed beats Pacemaker not captured	Pacemaker not pacing Extreme Tachy Extreme Brady Nonsus. Vtrac Vent. Brady BRHYTHM Multif. PVC PVCs / min High PAUSE Irr. Rhythm Marked Irr. Rhythm
ST-segment measurement		
Measurement range	-2.0 mV ~ +2.0 mV	
Accuracy	-0.8 mV ~ +0.8 mV; ± 0.04 mV or $\pm 10\%$, whichever is greater. Other range: Unspecified.	

A.4.1 RESP Specification

Measurement method	Impedance
Respiratory lead	Lead I and II are optional
Measurement impedance Range	0.3Ω ~ 0.5Ω
Base line impedance range	500 Ω ~ 2500Ω

Differential input impedance	>2.5MΩ	
Bandwidth	0.2Hz~2.5 Hz	
Scan speed	6.25 mm/s, 12.5 mm/s, 25 mm/s, 50mm/s	
RR		
Measurement range	0 rpm~150 rpm	
Resolution	1 rpm	
Accuracy	7 rpm ~ 150 rpm, ±2 rpm or ±2%, whichever is greater; 0 rpm+~6 rpm, no definition;	
Apnea delay	10s~ 60s, no alarming	
Alarm limit specification	Range (rpm)	Step (rpm)
RR alarm high limit	(low limit+1) ~150	1
RR alarm low limit	0~ (high limit-1)	

A.4.3 SpO₂ Specification

Meet the standard	ISO 80601-2-61
Note: claims for accuracy of SpO ₂ should be supported by clinical study measurements covering the entire range. Artificial induction to different stable oxygen levels, making it in the range of 100% ~70% SpO ₂ . Comparing the SpO ₂ value of the test product with the secondary standard oxygen saturation measuring equipment at the same time, and forming a pair of data as the accuracy analysis. Because the measurement of pulse oximeter products is only distributed by statistical probability, only about 2 / 3 of the measured values of pulse oximeter products fall within the accuracy (Arms) measured by carbon monoxide blood gas analyzer.	
Measurement and display range	0 %~100%
Resolution	1%
Accuracy	70 %~100 %: ±2 %; 0 %~69 %: No definition;
Sensitivity	High, middle, low

Red light	660nm	
Infrared light	905±5 nm	
Emitted light energy	6.75 mW	
Alarm limit specification	Range(%)	Step(%)
SpO ₂ high limit	(Low limit + 1) ~100	1
SpO ₂ low limit	0~ (high limit-1)	
PR		
Measuremene and display range	25 bpm~250 bpm	
Resolution	1 bpm	
Accuracy	± 2 bpm or ± 2 %, whichever is greater.	
Updating recycle	1 s	
Alarm limit specification	Range(%)	Step(bpm)
PR high limit	(Low limit + 1) ~250	1
PR low limit	25~ (high limit-1)	

A.4.4 NIBP specification

Meet the standard	IEC60601-2-30
Measurement method	Self-oscillation method
Working mode	Manual, Auto, STAT, Order
NIBP completion tone	On / Off
Whole point measurement	On / Off
Measurement interval in AUTO Mode	1 min, 2 min, 2.5 min, 3 min, 5 min, 10 min, 15 min, 20 min, 30 min, 1 h, 1.5 h, 2 h, 3 h, 4 h, 8 h.

Measuring period in STAT Mode	5 min			
Maximum single measurement time	Adult and pediatric: 180 s Neonatal: 90 s			
Measurement parameters	SYS, DIA, MEAN			
NIBP Measurement range	Blood pressure (unit)	Adult	Pediatric	Neonatal
	SYS mmHg	30 ~ 270	30 ~ 235	30 ~ 135
	kPa	4 ~ 36.0	4 ~ 31.3	4 ~ 18.0
	DIA mmHg	10 ~ 220	10 ~ 195	10 ~ 100
	kPa	1.3 ~ 29.3	1.3 ~ 26.0	1.3 ~ 13.3
	MEAN mmHg	20 ~ 235	20 ~ 210	20 ~ 110
	kPa	2.7 ~ 31.3	2.7 ~ 28.0	2.7 ~ 14.7
Accuracy	Maximum mean error: ± 5 mmHg Maximum standard deviation : 8 mmHg			
Static pressure measurement range	0 kPa (0 mmHg) ~ 40 kPa (300mmHg)			
Static pressure measurement accuracy	± 0.4 kPa (± 3 mmHg)			
Pressure resolution	1 mmHg			
Cuff pressure accuracy	± 3 mmHg			
Setting range of initial inflation pressure (mmHg)	Adult: 80~240 Pediatric: 80~ 200 Neonate: 60~ 120			

Default value of initial inflation pressure (mmHg)	Adult: 160 Pediatric: 140 Neonate: 90	
Over-pressure protection	Adult: 297 mmHg ± 3 mmHg Pediatric: 260 mmHg ± 3 mmHg Neonate: 147 mmHg ± 3 mmHg	
Alarm limit specification	Range (mmHg)	Step (mmHg)
High limit of systolic pressure	Adult: (Low limit+1) ~ 270 Pediatric: (Low limit+1) ~ 235 Neonate: (Low limit+1) ~ 135	
Low limit of systolic pressure	30~ (high limit-1)	
High limit of diastolic pressure	Adult: (Low limit+1) ~ 220 Pediatric: (Low limit+1) ~ 195 Neonate: (Low limit+1) ~ 100	1
Low limit of diastolic pressure	10~ (high limit-1)	
High limit of mean pressure	Adult: (Low limit+1) ~ 235 Pediatric: (Low limit+1) ~ 210 Neonate: (Low limit+1) ~ 110	
Low limit of mean pressure	20~(high limit-1)	

A.4.5 TEMP specification

Meet the standard	ISO 80601-2-56
Measurement method	Thermistor method
Channel	Dual-channel
Probe type	YSI-2.252 K
Measurement site	Body surface probe: armpit Body cavity probe: oral, rectum
Measurement range	0 °C ~ 50 °C (32 °F~ 122 °F)
Resolution	0.1 °C

Accuracy	$\pm 0.1^{\circ}\text{C}$	
Updating recycle	Around 1s	
Response mean time	<10 s	
Alarm response time	$\leq 2\text{min}$	
Unit	$^{\circ}\text{C}$ or $^{\circ}\text{F}$	
Alarm limit specification	Range ($^{\circ}\text{C}$)	STEP ($^{\circ}\text{C}$)
T1 / T2 high limit	(Low limit+0.1) ~ 50	0.1
T1 / T2 low limit	0 ~ (high limit-0.1)	
TD high limit	0 ~ 150	

A.4.6 IBP specification

Meet the standard	IEC60601-2-34	
Measurement method	Invasive and direct measurement	
IBP Specification		
Measurement range	-50 mmHg~ 300 mmHg (-6.7 kPa~ 40.0 kPa)	
Resolution	1 mmHg (0.1 kPa)	
Accuracy	$\pm 2\%$ or 1 mmHg, whichever is greater.	
Updating recycle	1s	
Air volume displacement < 0.04 mm ³ / 100 mmHg		
Pressure sensor		
Sensitivity	5 $\mu\text{V/V}$ / mmHg	
Impedance range	300 n ~ 3000 n	
Volume displacement	<0.04 mm ³ / 100 mmHg	
Alarm limit specification	Range (mmHg)	Step (mmHg)
SYS ALM HI	(Low limit+1) ~300	1
MEAN ALM HI		
DIA ALM HI		
SYS ALM LO		
MEAN ALM LO		
DIA ALM LO		

A.4.7 CO₂

Measurement mode	Mainstream and sidestream
Measurement method	Infrared radiation absorption technology
Apnea alarm delay	10s ~ 60s no alarming

Alarm limit specification	Range	Step
EtCO ₂ high limit	(Low limit+1 mmHg)~150 mmHg	1 mmHg
EtCO ₂ low limit	0 mmHg~50 mmHg	
FiCO ₂ high limit	3 mmHg~50 mmHg	
awRR high limit	Sidestream: (Low limit +1 rpm) ~120 rpm Mainstream: (Low limit+1 rpm) ~150 rpm	1 rpm
awRR low limit	0 rpm~(high limit-1 rpm)	

Sidestream CO₂ module

Meet the standard	ISO 80601-2-55
CO ₂ measurement range	0 mmHg~150 mmHg
Accuracy	0 mmHg~ 40 mmHg: ± 2 mmHg 41 mmHg~70 mmHg: Reading ± 5 % 71 mmHg~100 mmHg: Reading ± 8 % 101 mmHg~150 mmHg: Reading ± 10 %
Accuracy of measurement of mixed gas $\pm (0.43\% \text{ volume percent} + 8\% \text{ of gas concentration})$	
Accuracy drift	Meet accuracy requirements within 6h ($\pm (0.43\% \text{ volume percent} + 8\% \text{ of gas concentration})$)
Resolution	1 mmHg
Initialization time	At 25 °C, inspiration/ expiration CO ₂ curve can be displayed within 20s, which meets all specification within 2 minutes.
awRR	
Measurement range	2 rpm~120 rpm
Measurement accuracy	± 1 rpm
Resolution	1 rpm

Mainstream CO₂ module

Meet the standard	ISO 80601-2-55
CO ₂ measurement range	0 mmHg~150mmHg

Accuracy	0 mmHg~ 40 mmHg: ± 2 mmHg 41 mmHg~70 mmHg: Reading ± 5 % 71 mmHg~100 mmHg: Reading ± 8 % 101 mmHg~150 mmHg: Reading ± 10 %
Accuracy drift	Meet accuracy requirements within 6 h ($\pm(0.43\%$ volume percent+8% of gas concentration))
Resolution	1 mmHg
Rise time	<60 ms—repeatable or disposable airway interface for adult. <60 ms—repeatable or disposable airway interface for pediatric.

Effect of Interface gases on CO₂ Measurement

Gas	Concentration (%)	Accuracy
N ₂ O	≤ 60	
Hal	≤ 4	
Enf	≤ 5	± 1 mmHg
Iso	≤ 5	
Sev	≤ 5	
Des	≤ 15	± 2 mmHg

Appendix B EMC Test Level Declaration-Guidance Manufacture's Declaration

NOTE

- Devices or systems should not be used when they are close to or stacked with other equipment, if necessary, please observe and verify that they can operate normally in the configurations.
- Portable and mobile RF equipment may affect the use of medical electrical equipment.
- Active medical devices are subject to special BMC precautions and they must be installed and used in accordance with these guidelines.
- Using accessories, transducers and cables other than those specified may result in increased electromagnetic emission or decreased electromagnetic immunity of the patient monitoring equipment.
- The device requires special precautions for electromagnetic compatibility (EMC) and requires qualified personnel to install and use in accordance with the EMC information provided below.
- Electromagnetic fields can affect the performance of the device, so other equipment used near the equipment must meet the appropriate EMC requirements. Mobile phones, X-rays, or MRI devices are possible interference sources, as they emit high-intensity electromagnetic radiation.

Table 1: Electromagnetic emission

! nce and manufacture's declaration-electromagnetic emission		
Emission test	Compliance	Electromagnetic environment-guidance
RF emissions CISPR 11	Group 1	The device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby
RF emissions CISPR 11	Class A	The device is suitable for use in all establishments other than domestic and those indirectly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions TEC 61000-3-2	Class A	
Voltage fluctuations/flicker emission IEC 61000-3-3	Complies	

WARNING

- The device is intended to be used only by professional medical personnel. The deive system may cause radio interference or disturb operation of nearby equipment, so it is necessary to take measures to mitigate, such as, readjust the direction, relocate this device or shield corrsponding sites.

Table 2: Electromagnetic immunity 1

Guidance and manufacturer's declaration-electromagnetic immunity			
The device is intended for use in the electromagnetic environment specified below. The customer or the user should assure that it is used in such an environment.			
Immunity test	IEC60601 test level	Compliance level	Electromagnetic environment-guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±15 kV air	±8 kV contact ±15 kV air	Floors should be wood, concrete or ceramic tile. If floor are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines; ±1 kV for input/output signal;	±0.5kV for power supply lines; ±1 kV for input/output signal;	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV Line to Line ±2 kV Line to Earth	±1 kV Line to Line ±2 kV Line to Earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short	<5% U_T (>95% dip in U_T) for 0.5 cycle	<5% U_T (>95% dip in U_T) for 0.5 cycle	Mains power quality should be that of a typical

interruptions and voltage variations on power supply input lines IEC 61000-4-11	40% UT (60% dip in UT) for 5 cycle 70% UT (30% dip in UT) for 25 cycle <5% UT (>95% dip in UT) for 5 sec	40% UT (60% dip in UT) for 5 cycle 70% UT (30% dip in UT) for 25 cycle <5% UT (>95% dip in UT) for 5 sec	commercial or hospital environment. If the user requires continued operation during power mains interruptions, it is recommended that the device be powered from an uninterruptible power supply or a battery.
Power frequency (50/60Hz) magnetic field IEC 61000-4-8	3A/m	3A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

NOTE UT is the a.c. mains voltage prior to application of the test level.

Table 3: Electromagnetic immunity 2

Guidance and Manufcature's declaration electromagnetic immunity			
Immunity test	IEC60601 test level	Compliance level	Electromagnetic environment-guidance
Conducted RF IEC61000-4-6	3Vrms 150KHz to 80MHz	3Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the Patient Monitor including
Radiated RF IEC1000-4-3	3V/m 80MHz	3V/m	

	to 2.5GHz		cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 3.5\sqrt{P}$ $d = 3.5\sqrt{P}$ 80MHz to 800MHz $d = 2.3\sqrt{P}$ 800MHz to 2.5GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey. ^a should be less than the compliance level in each frequency range. ^b Interference may occur in the vicinity of equipment marked with the following symbol: 	
NOTE 1 At 80MHz and 800 MHz, the higher frequency range applies.				

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.
^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Patient Monitor is used exceeds the applicable RF compliance level above, the Patient Monitor should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Patient Monitor .
^b Over the frequency range 150 KHz to 80 MHz, field strengths should be less than IV/m(80-800MHz)&3V/m(800-2500MHz).

Table 4: Recommended separation distances

Recommended separation distances between portable and mobile RF communications equipment and Patient Monitor			
The Patient Monitor is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Patient Monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Patient Monitor as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter (W)	Separation distance according to frequency of transmitter (m)		
	150KHz to 80MHz $d = 3.5\sqrt{P}$	80MHz to 800MHz $d = 3.5\sqrt{P}$	800MHz to 2.5GHz $d = 2.3\sqrt{P}$
0.01	0.3500	0.3500	0.2334
0.1	1.1068	1.1068	0.7378
1	3.5000	3.5000	2.3334
10	11.0860	11.0860	7.3786
100	35.0000	35.0000	23.3334

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80MHz and 800MHz the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Appendix C Default settings information**C.1 Alarm**

Name	Manufacturer Default Setup
ALARM VOL	General: 2 OR: 1 Other: 2
ALM PAUSE TIME	2min
ALM TYPE	UNLATCH
ALM SOUND	ON
ALM PROMPT TONE	NO
WAVEFORM LENGTH	16 s
APNEA DELAY	Adult: 20 s Pediatric / neonate: 15 s
ALM DELAY	6s
ST ALM DELAY	30 s

C.2 ECG

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
FILTER	General monitor: Monitor Surgery / Anesthesia monitor: Surgery Intensive monitor / Neonatal intensive monitor: Intensive monitor Cardiac intensive monitor: Diagnosis		
HR ALARM	ON		
ALM LEV	MED		
ALM REC	OFF		
ALM HI	120 bpm	160 bpm	200 bpm
ALM LOW	50bpm	75 bpm	100 bpm
HR FROM	HR		
HR CHANNEL	CHI		
LEAD TYPE	5/12 LEAD		
ECG GAIN	2.5 mm/m V(x0.25),5 mm/mV(x0.5),10 mm/Mv(x1),20mm/mV(x2)		
WAVE SPEED	25.0 mm/s		
HR VOL	2		

PECING	NO
GAIN	XI
POWER FREQUENCY NOTCH	OFF

Arrhythmia Analysis

Name	Manufacturer Default Setup		
	Alarm Switch	Alarm Level	Alarm Record
ASYSTOLE	ON	HIGH	OFF
VFIB /VTAC	ON	HIGH	OFF
RONT	OFF	MED	OFF
VT>2	OFF	LOW	OFF
COUPLET	OFF	PROMPT	OFF
PVC	OFF	PROMPT	OFF
BIGEMINY	OFF	MED	OFF
TRIGEMINY	OFF	MED	OFF
SVT	OFF	MED	OFF
BRADYCARDIA	OFF	MED	OFF
PNC	OFF	PROMPT	OFF
PNP	OFF	PROMPT	OFF
MISSED BEATS	OFF	PROMPT	OFF
ET (Extreme Tachy)	ON	HIGH	OFF
EB (Extreme Brady)	ON	HIGH	OFF
NONSUS. VTRAC	OFF	MED	OFF
VENTBRADY	ON	HIGH	OFF
BRHYTHM	OFF	MED	OFF
MULTIFPVC	OFF	MED	OFF
PVCs / MIN HIGH	OFF	MED	OFF
PAUSE	OFF	LOW	OFF
IRR.RHYTHM	OFF	MED	OFF
MARKED IRR.RHYTHM	OFF	MED	OFF

Arrhythmia threshold setup

Name	Manufacturer Default Setup	
	Adult	Pedi
Asystole Time	5	5
Ventricular Tachycardia	130	130
Ventricular Tachycardia		
PVCs	6	6
Multif. PVC Bandwidth	15	15
Tachycardia	120	160
Bradycardia	50	75
Extreme Tachy	160	35
Extreme Brady	180	50
Vent. Brady	40	40
Vent. Brady PVCs	5	5
Pause Time	2	2

S-T Segment Analysis

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
ST ANAL	OFF		
ST ALM	OFF		
ST ALM LEV	MED		
ST ALM REC	OFF		
ST ALM HI	0.20 mV		
ST ALM LO	-0.20 mV		
ISO Point	-80 ms		
J Point	48 ms		
ST Point	J + 60 ms		

C.3 Resp

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
ALM	ON		
ALM LEV	MED		
ALM REC	OFF		

ALM HI	30rpm	100 rpm
ALM LO	8rpm	30rpm
SPEED	6.25 mm/s	
APENA ALM	20s	15 rpm
WAVE AMP	X2	
RESP LEAD	II	

C.4 SPO₂

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
SPO ₂ ALM	ON		
ALM LEV	MED		
ALM REC	OFF		
SpO ₂ ALM HI	100	100	95
SpO ₂ ALM LO	90	90	90
SPEED	25 mm/s		
NIBP Same Side	off		
MEANTIME	8s		
Sensitivity	Med		
Big PI	No		

C.5 PR

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
PR ALM HI	120 bpm	160 bpm	200
PR ALM LO	50bpm	75 bpm	100
PR FROM	SpO ₂		
PULSE VOL	2		

C.6 NIBP

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
ALARM	ON		

ALM LEV	MED		
ALM REC	OFF		
SYS ALM HI	160mmHg	120mmHg	90mmHg
SYS ALM LO	90mmHg	70mmHg	40mmHg
MEAN ALM HI	110mmHg	90mmHg	70mmHg
MEAN ALM LO	60mmHg	50mmHg	25 mmHg
DIA ALM HI	90mmHg	70mmHg	60mmHg
DIA ALM LO	50mmHg	40mmHg	20mmHg
UNIT	mmHg		
INTERVAL	MANUAL		
INFLATION	160mmHg	140mmHg	90mmHg

C.7 TEMP

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
ALARM	ON		
ALM LEV	MED		
ALM REC	OFF		
TI / TD2 ALM HI	38.0		
TI / TD2 ALM LO	35.0		
TD ALM HI	2.0		
UNIT	°C		

C.8 IBP

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
ALARM	ON		
ALM LEV	MED		
ALM REC	OFF		
SPEED	25 mm/s		
ABP-S	[90, 160]	[70, 120]	[55, 90]

ABP-M	[70, 110]	[50, 90]	[35, 70]
ABP-D	[50, 90]	[40, 70]	[20, 60]
ART-S	[90, 160]	[70,120]	[55,90]
ART-M	[70, 110]	[50, 90]	[35, 70]
ART-D	[50, 90]	[40, 70]	[20, 60]
PA-S	[10, 35]	[24, 60]	[24, 60]
PA-M	[0, 20]	[12, 26]	[12, 26]
PA-D	[0, 16]	[-4, 4]	[-4, 4]
CVP-M	[0, 10]	[0,4]	[0,4]
LAP-M	[0, 10]	[0,4]	[0,4]
RAP-M	[0, 10]	[0,4]	[0,4]
ICP-M	[0, 10]	[0,4]	[0,4]
PI-S	[90, 160]	[70, 120]	[55, 90]
PI-M	[70, 110]	[50, 90]	[35, 70]
PI-D	[50, 90]	[40, 70]	[20, 60]
P2-S	[90, 160]	[70, 120]	[55, 90]
P2-M	[70, 110]	[50, 90]	[35, 70]
P2-D	[50, 90]	[40, 70]	[20, 60]

C.9 CO₂

Name	Manufacturer Default Setup		
	Adult	Pedi	Neo
ALARM	ON		
ALM LEV	MED		
ALM REC	OFF		
WORK.MODE	Sleep		
SPEED	6.25 mm/s		
O ₂ CONCENTRATION	NICU: 100 Others: 21		
BALANCE GAS	AIR		
ANESTHETIC GAS CONCENTRATION	0		

PR Source	Auto		
APNEA DELAY	20 s	20 s	15 s
EtCO ₂ ALM HI	50	50	45
EtCO ₂ ALM LO	25	25	30
FiCO ₂ ALM HI	4	4	4
RR ALM HI	30	30	100
RR ALM LO	8	8	30
CO ₂ Scale (mmHg)	50		
UNIT	mmHg		

Appendix D Alarm Information

Some important physiological and technical alarm information are listed in this chapter, some alarm information are not listed.

Notes:

The I column indicates how the technical alarm is cleared. "A" represents completely cleared, "B" represents clearing audio and light alarms, "C" represents that it cannot be completely cleared.

The L column indicates the default alarm levels: H is high level, M is medium level, L is low level, the one with "*" indicating that the level can be set by the user.

The "XX" represents the name of module or physiological parameter such as ECG, NIBP, HR, ST-I, PVCs, RR, SpO₂ or PR.

Corresponding measures are provided for each alarm, if the problem can not be solved after taking measures, please contact the maintenance personal

D.1 Physiological alarm information

General physiological alarm

Alarm messages	L	Causes and Measures
"XX HIGH"	M*	XX value is higher than the high limit or lower than the low limit. Check the physical conditions of patient, and make sure the setting of patient type and alarm limits are suitable for current patient.
"XX LOW"	M*	

Arrhythmia alarm information

Alarm messages	L	Causes and Measures
"ASYSTOLE"	H	
"VFIB / VTAC"	H	
VENT-BRADY	H	
ET (Extreme Tachy)	H	
EB (Extreme Brady)	H	
RonT	M*	
PVCs/min	M*	
"VT>2"	M*	
"COUPLET"	M*	
"PVC"	M*	
"BIGEMINY"	M*	
"TRIGEMINY"	M*	

"TACHY"	M*	
"BRADY"	M*	
"MISSED BEATS"	M*	
IRR.RHYTHM	M*	
MARKED IRR. RHYTHM	M*	
NONSUS. VTRAC	M*	
MULTIF. PVC	M*	
BRHYTHM	M*	
PAUSE	M*	
"PNP"	M*	
"PNC"	M*	The working status of pacemaker is abnormal, please check the pacemaker

Respiratory physiological alarm information

Alarm messages	L	Causes and Measures
"RESP APNEA"	H	The respiration signal of the patient is so weak that the system cannot perform RESP analysis. Check the patient's condition, electrodes, cables and lead wires. Check the connection of RA, RL or LL, at least one of them is not well connected.
Resp Disturbed	H	Respiration is interfered by patient's heartbeat, the respiration rate cannot be measured correctly. Check the patient's condition, electrodes, cables and lead wires.

CO2 physiological alarm information

Alarm messages	L	Causes and Measures
"RESP APNEA"	H	The patient is not breathing, or the respiration signal is so weak that can not be analyzed by the system. Check patient's condition, accessories and airway connection.

AG physiological alarm information

Alarm messages	L	Causes and Measures

"RESP APNEA"	H	The patient is not breathing, or the respiration signal is so weak that can not be analyzed by the system. Check patient's condition, accessories and airway connection.
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D.2 Technical alarm information

General technical alarm

Alarm messages	L	Causes and Measures
XX NOT INSERTED	N	The module is not inserted into the host. Insert the module into the host.

ECG technical information

Alarm messages	L	Causes and Measures
ECG Lead Off	L*	Electrode is not firmly connected to patient, or it falls off, or lead cable falls off the main cable. Check the connection of electrodes and lead cables.
ECG YY Lead Off	L*	
ECG YY Lead Saturated	L	
YY represents V, LL, LA, RA, C, F, L, R, VI, V2, V3, V4, VS, V6, C1, C2, C3, C4, C5 or C6.		
Data Sent Fast	H	Try to re-plug the module, if the fault persists, please contact the maintenance personal.
Data Sent Slow	H	
"SELF-LEARNING"	L	The system is self-learning
"ECG WEAK SIGNAL"	L	Check the connection between the electrode and lead cable; Check the patients' condition.
ECG Noise	L	Check the connection of ECG lead cable, check the patient's condition, and avoid the patient moving a lot.

Respiration technical alarm information

Alarm messages	L	Causes and Measures
RESP OFF	L	Check the connection of RA, RL or LL lead. At least one lead among RA, RL and LL is not connected correctly.

TEMP technical alarm information

Alarm messages	L	Causes and Measures
Temp Calibration Failed	H	Calibration error for temperature channel, please restart the device.
"T1 PROBE OFF"	L	Temperature sensor falls off the patient or module. Check the connection of sensor.
"T2 PROBE OFF"	L	

SpO₂ technical alarm information

Alarm messages	L	Causes and Measures
SpO ₂ SENSOR OFF	L*	
SpO ₂ SENSOR FAILURE	L	
SpO ₂ SENSOR NOT CONNECTED	L	
SpO ₂ SENSOR NOT RECOGNIZED	L	
SpO ₂ SENSOR NOT COMPATIBLE	L	
TOO STRONG BACKGROUND LIGHT	L	The light around the sensor is too strong, and the photoelectric detector of the sensor absorbs the surrounding light. Move the sensor to a low-light area or cover the end of the probe.
POOR SpO ₂ SIGNAL	L	The quality of the sensor's signal is poor. Check the patient's condition and reposition the sensor in a suitable position. If the fault exists, replace the sensor.
NO PULSATION	L	SpO ₂ sensor can not get pulsation signal. Check the patient's condition and reposition the sensor in a suitable position. If the fault exists, replace the sensor.
SpO ₂ INTERFERENCE	L	Interference signal appears. Check whether there is interference source around the sensor, check the patient's current condition, and avoid the patient moving a lot.

SpO ₂ MODULE COMMUNICATION ABNORMAL	L	Module failure, or module communication with the host failure. Try to plug and unplug the module again, power on again or plug the module to another host.
SpO ₂ MEASUREMENT BOARD ERROR	L	The MPM SpO ₂ module works abnormally and the measurement may not be accurate. Stop using the module and contact maintenance personnel.
" SpO ₂ PROBE OFF"	L	Check the connection of SpO ₂ sensor.
" SpO ₂ SEARCH TIMEOUT"	L	The pulse signal of the patient is so small that the system cannot perform pulse signal analysis. Check the connection of sensor; Check the patient's condition.
SEARCH FOR PULSE	L	The patient's pulse is being checked

NIBP technical alarm information

Alarm messages	L	Causes and Measures
"NIBP LOOSE CUFF"	L	The NIBP cuff is not applied correctly, or not connected properly or there are leaks in the airway.
"NIBP AIR LEAK"	L	
"NIBP AIR PRESSURE ERR"	L	Valve cannot be opened normally or ambient atmospheric pressure is abnormal. Make sure that the environment meets the specifications of the monitor, and whether there are special reasons that effect the environmental pressure.
"NIBP WEAK SIGNAL"	L	It is possible that the patient pulse is too weak or cuff is too loose. Check patient's condition, re-apply the cuff to an appropriate part. If the failure still exists, replace the cuff.
"NIBP RANGE EXCEEDED"	L	It may be that patient's blood pressure value exceeds the measurement range.
"NIBP EXCESSIVE MOTION"	L	There are too many interferences in the signal when measuring, check patient's condition to prevent patient's arm from moving.
"NIBP OVER PRESSURE"	L	Cuff pressure exceeds the range (adult: 300mmHg, pediatric: 240mmHg, neonate: 150mm Hg). Or blockage occurs in the airway, check the airway, and measure again.
"NIBP SIGNAL SATURATED"	L	Signal amplitude is large due to movement or other reasons.
"NIBP leak detection failed"	L	It is found that the system has airway leakage during leakage detection.
"NIBP SYSTEM FAILURE"	H	Failure occurs during measuring, system can not perform analysis and calculation. Check patient's situation, connection situation, air pump, A/D sampling and pressure sensor or replace the cuff, then measure again.

"NIBP TIME OUT"	L	The measurement exceeds the specified time, the measurement time of adult/pediatric cuff pressure over 200mmHg is 120s, below 200mmHg is 90s, the measurement time of neonate is 90s.
Cuff type error	L	Check the type of the cuff

IBP technical alarm information

Alarm messages	L	Causes and Measures
YY PROBE OFF	L*	Check the sensor connection and re-connect.
YY PROBE failure	M	Something wrong with the IBP sensor, please replace it
YY Disconnect	H	The liquid circuit is disconnected from the patient, or a three-way stopcock is opened to the atmosphere. Check the liquid connection or check whether the three-way stopcock leads to the patient end. If the failure still exists, contact the manufacturer.
YY HAS NO PULSE	L	The hose may be blocked, please flush the hose.
YY NEEDS ZERO CALIBRATION	L	Performing zero-calibration
YY represents the name of IBP.		

CO₂ technical alarm information

Alarm messages	L	Causes and Measures
CO ₂ MODULE OVER TEMP	H	Check the sensor, and stop using it or replace it. Make sure the module is not exposed to extreme heat, such as heat lamp. If error exists, return the module to factory for repair.
CO ₂ MODULE ZEROING	N	It is executing zero calibration.
CO ₂ MODULE WARMING-UP	N	The sensor has just entered startup stage.
CO ₂ MODULE	L	This error occurs when the air pump pressure exceeds the preset range.

CHECK SAMPLING CANNULA		Check that the sampling cannula is not occluded or twisted.
CO ₂ MODULE NEEDS ZERO CALIBRATION	L	If zeroing is required, check if airway sampling cannula need to be cleaned or replaced. zeroing needs to be performed more than once, there may be a hardware error.
CO ₂ OUT OF RANGE	L	The CO ₂ calculation value exceeds limit (150mmHg, 20.0Kpa or 19.7%). The maximum value exceeds the upper limit of CO ₂ . If the error persists, perform zero calibration.
CO ₂ MODULE CHECK AIRWAY SAMPLING CANNULA	L	Normally, it appears when the airway sampling cannula moves out of the module, or there is a visible blockage in the airway sampling cannula. If mucus or water vapor is seen, it is necessary to clean or replace the airway sampling cannula. After cleaning, execute module zero calibration.
CO ₂ module error	H	Check that the module is connected properly and re-plug or reset the module if necessary. Or try to plug the module into a different host for power supply. If the error exists, return the module to the factory for repair.
CO ₂ NOT DETECT RESPIRATION	L	This message appears when the respiration is not detected during the set period.
NEGATIVE CO ₂ ERR	L	This error occurs when the calculated CO ₂ value is less than 0 for a certain period of time. When the module still has CO ₂ in the airway or when there is a visible obstruction in the airway sampling cannula, zero calibration will cause

		this error. Check whether the airway sampling cannula needs to be cleaned.
CO ₂ SENSOR ERR	L	Check that the module is connected properly and re-plug or reset the module if necessary. Or try to plug the module into a different host for power supply. If the error exists, return the module to the factory for repair. If the current pneumatic system error can be requested to be repaired. This setting will no longer be cleared.
CO ₂ AIRPUMP LIFE EXCEEDED	L	Connect the sampling cannula.
CO ₂ SAMPLING CANNULA DISCONNECTED	L	

Power supply technical alarm

Alarm messages	L	Causes and Measures
SV IS TOO HIGH	H	
SV IS TOO LOW	H	
3.3V IS TOO HIGH	H	
3.3V IS TOO LOW	H	
"LOW BATTERY"	H	Connect with the AC power for power supply, and charge the battery at the same time. The battery is available to use after being fully charged.

Recorder technical alarm information

Alarm messages	L	Causes and Measures
"RECODER ERR"	L	The recorder is not connected or its communication is abnormal. Connect the recorder or check the connection lines of recorder.
"PRINTER LOW POWER"	H	System power failure and restart.
"RECODER OUT OF PAPER"	L	Install the recording paper.

Appendix E Abbreviations

E.1 Unit list

Abbreviation	Description
μA	microampere
μV	microvolt
A	ampere
Ah	ampere hour
bpm	beat per minute
$^{\circ}\text{C}$	centigrade
cm	centimeter
dB	decibel
$^{\circ}\text{F}$	fahrenheit
g	gram
h	hour
Hz	hertz
inch	inch
k	kilo
kg	kilogram
kPa	kilopascal
L	litre
lb	pound
m	meter
mAh	milliampere hour
mcg	microgram
mEq	milli-equivalents
mg	milligram
min	minute
ml	milliliter
mm	millimeter
mmHg	millimeters of mercury
cmH ₂ O	centimeters of water
ms	millisecond
mV	millivolt
mW	milliwatt
MQ	megaohm
nm	nanometer
rpm	breaths per minute

s	second
v	volt
VA	volt ampere
Q	ohm
w	watt

E.2 Terminology list

Abbreviation	Description
AC	Alternating current
Adu	adult
AHA	American Heart Association
Art	arterial
aVF	left foot augmented lead
aVL	left arm augmented lead
aVR	right arm augmented lead
AwRR	airway respiratory rate
BP	blood pressure
CCU	cardiac (coronary) care unit
CMS	central monitoring system
COHb	carboxyhemoglobin
CVP	central venous pressure
DC	direct current
Dia	diastolic
DPI	dot per inch
ECG	electrocardiograph
EMC	electromagnetic compatibility
EMI	electromagnetic interference
ESD	electro-static discharge
ESU	electrosurgical unit
EtO	ethylene oxide
HR	heart rate
ICG	Impedance cardiography
ICT/B	intracranial catheter tip pressure transducer
ICU	intensive care unit
IEC	International Electrotechnical Commission

IEEE	Institute of Electrical and Electronic Engineers
IBP	Invasive brood pressure
IP	internet protocol
LA	left arm
LAP	left atrial pressure
LCD	liquid crystal display
LED	light emitting diode
LL	left leg(electrode)
MAP	mean arterial pressure
MetHb	methemoglobin
MRI	magnetic resonance imaging
N/A	not applied
Neo	neonate
NIBP	noninvasive blood pressure
oxyCRG	oxygen cardio-respirogram
Ped	pediatric
Pleth	plethysmogram
PR	pulse rate
PVC	premature ventricular contraction
RA	right arm
Rec	record, recording
Resp	respiration
RL	right leg(electrode)
RR	respiration rate
SpO ₂	arterial oxygen saturation from pulse oximetry
SV	stroke volume
SYS	systolic pressure
TBW	Total body water
TD	temperature difference
TPR	total peripheral resistance
Temp	temperature
USB	universal serial bus



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